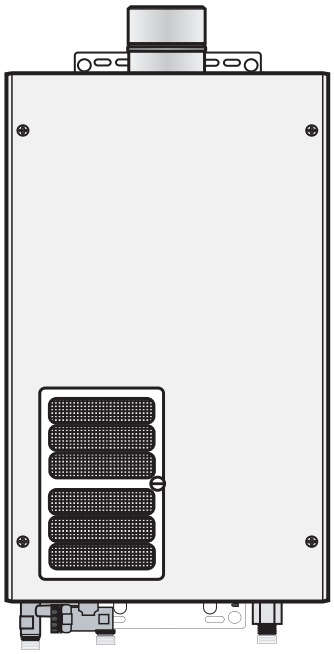
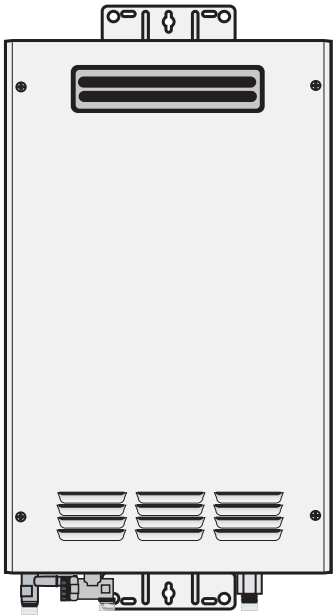
Paloma®

Tankless Gas Water Heaters

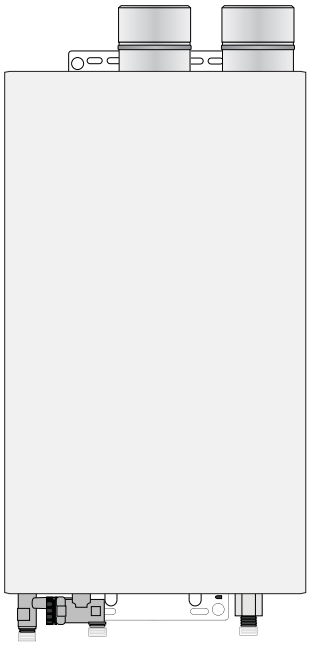
PH-28RIFSN; PH-28CIFSN (Indoor) (NAT. Gas)
PH-28RIFSP; PH-28CIFSP (Indoor) (L.P. Gas)
PH-28ROFN; PH-28COFN (Outdoor) (NAT. Gas)
PH-28ROFP; PH-28COFP (Outdoor) (L.P. Gas)
PH-28RDVSN; PH-28CDVSN (Direct Vent) (NAT. Gas)
PH-28RDVSP; PH-28CDVSP (Direct Vent) (L.P. Gas)
(R: Residentail Model; C: Commercial Model)



Indoor Water Heater



Outdoor Water Heater



Direct Vent Water Heater

DESIGN CERTIFIED ®

CERTIFIED ®

Engineering Handbook

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. To do so may result in an explosion or fire.

- WHAT TO DO IF YOU SMELL GAS
  *** Do not try to light any appliance.**
  *** Do not touch any electrical switch; do not use any phone in your building.**
  *** Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
  *** If you cannot reach your gas supplier, call the fire department.**
  *** Do not return to your home until authorized by the gas supplier or fire department.**

- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WARNING: Improper installation, adjustment, alternation, service or maintenance can cause property damage, personal injury, or death. For assistance or additional information, consult with a qualified distributor.

WARNING: The content on this manual is intended for use by qualified service personnel ONLY.

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SPECIFICATIONS (Approx.)

Model	PH-28RIFSN (NAT) PH-28RIFSP (L.P.) PH-28CIFSN (NAT) PH-28CIFSP (L.P.)	PH-28ROFN (NAT) PH-28ROFP (L.P.) PH-28COFN (NAT) PH-28COFP (L.P.)	PH-28RDVSN (NAT) PH-28RDVSP (L.P.) PH-28CDVSN (NAT) PH-28CDVSP (L.P.)
Purpose	Domestic Hot Water Supply & Circulating		
Rated Gas Input (Btu/Hr.)	19,000 (Min.) 199,900 (Max.)(Modulating)	19,000 (Min.) 199,900 (Max.)(Modulating)	19,000 (Min.) 199,900 (Max.)(Modulating)
Dimensions (in.)	14 7/8 (W) x 25 3/8 (H) x 11 1/8 (D)		
Net Weight (lbs.)	65		
Installation	Indoor Wall Mounting Type Can be vented either horizontally or vertically	Outdoor Wall Mounting Type	Direct Vent Indoor Wall Mounting Type Can be vented either horizontally or vertically
Working Water Pressure	14 psi ~ 150 psi		
Minimum Water Flow	0.66 GPM		
Maximum Flow Rate	7.4 GPM at 45ºF Temperature Rise		
Gas Connection	3/4” NPT Female (w/supplied Gas Shutoff Valve)		
Water Connection	3/4” NPT Male		
Vent Size	4” Special Venting (Category III)	N/A (Outdoor Installation)	4” Special Venting (Category III)
Max. Vent Length	37.5 Feet Three 90º Elbow	N/A (Outdoor Installation)	37.5 Feet Three 90º Elbow
Efficiency Rating	84%		
Energy Factor	0.82		
Inlet Gas Pressure before water heater	Natural Gas: Min. 4.0” w.c. Max. 10.5” w.c. L.P. Gas: Min. 8.0” w.c. Max. 14.0” w.c. (Do not exceed maximum pressure.)		
Hot Water Supply	Factory Setting	100ºF	
	Adjusting Range	R:100ºF ~ 120ºF (140ºF); C: 100°F ~ 180°F	
	Max. Setting	Up to 140ºF(R) or 180°F(C)(w/ Main Remote Control & Dip Switch Adj.)	
Electrical Portion	Electrical Rating	120VAC/60Hz, Less than 2 Amps	
	Power Supply Cord	3 Pin Power Supply Cord 10 Feet (Indoor & Direct Vent)	
Safety Devices	Oxygen Depletion Safety	Sensing Burner (Indoor & Direct Vent)	
	Over Heat Limiter	Film Type for Entire Heat Exchanger	
	Flame Failure Safety	Flame Rod Type	
Freeze Protection	Minus 30ºF (Without Wind-Chill Factor)		
Optional Accessory	First Bath Remote Control (USC1-117); Second Bath Remote Control (USC2-117) DUOnex ™ for 2-Unit Manifolding MIC-180 for Multi-Unit System Controller (2 to 6 units); MICS-180 for Expansion Board (Up to 20 units); MIC Communication Cables (16, 32 & 65 feet) High Altitude Adjustment Chips for use at altitudes above 3,280 feet, and up to 9.840 feet		

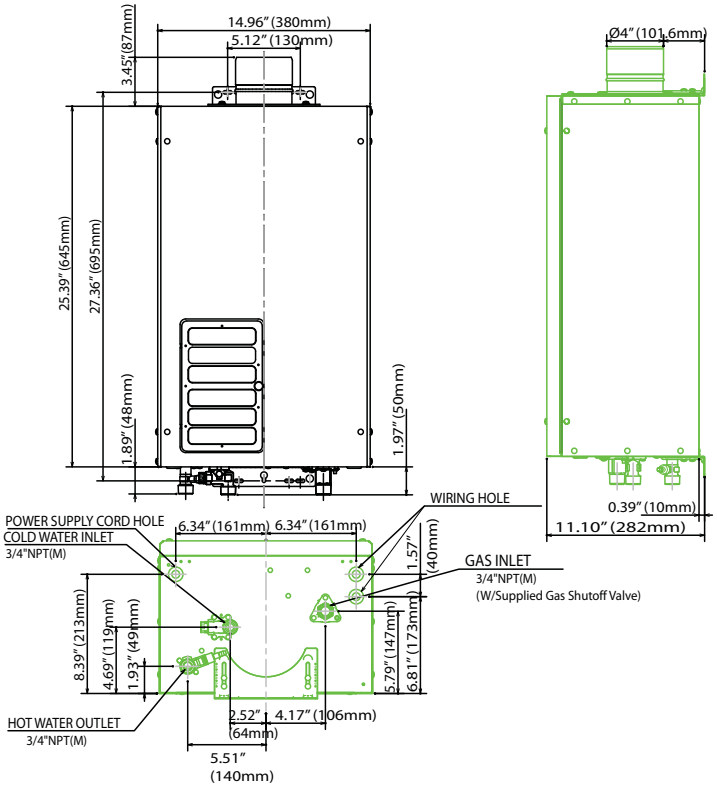
Hot Water Flow Rate and Temperature Rise							
Temp. Rise (ºF)	45	50	60	70	80	90	100
Water Flow (GPM)	7.4	6.7	5.6	4.8	4.2	3.7	3.4

Note: Special Venting: The adapter, vent pipe, elbow, vent terminal, etc. Should be UL 1738 Certified Category III Stainless Steel Venting Material (e.g. AL29-4C). **“B” vent is not permitted.**

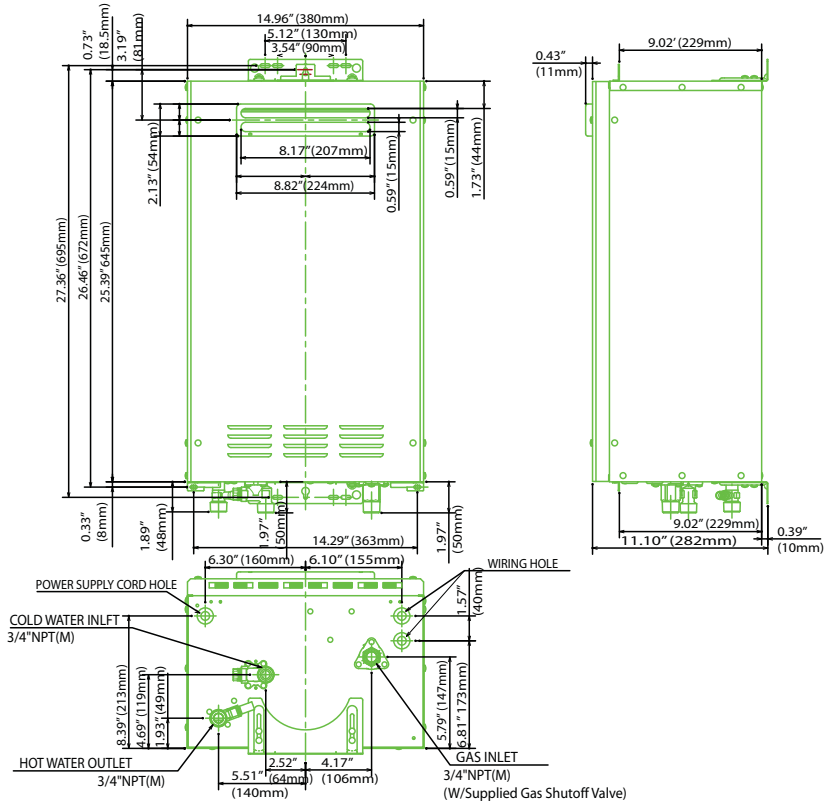
Since we are constantly improving our products, all specifications are subject to change without notice.

EXTERNAL DIMENSIONS

(PH-28RIFS & PH-28CIFS Indoor Model)

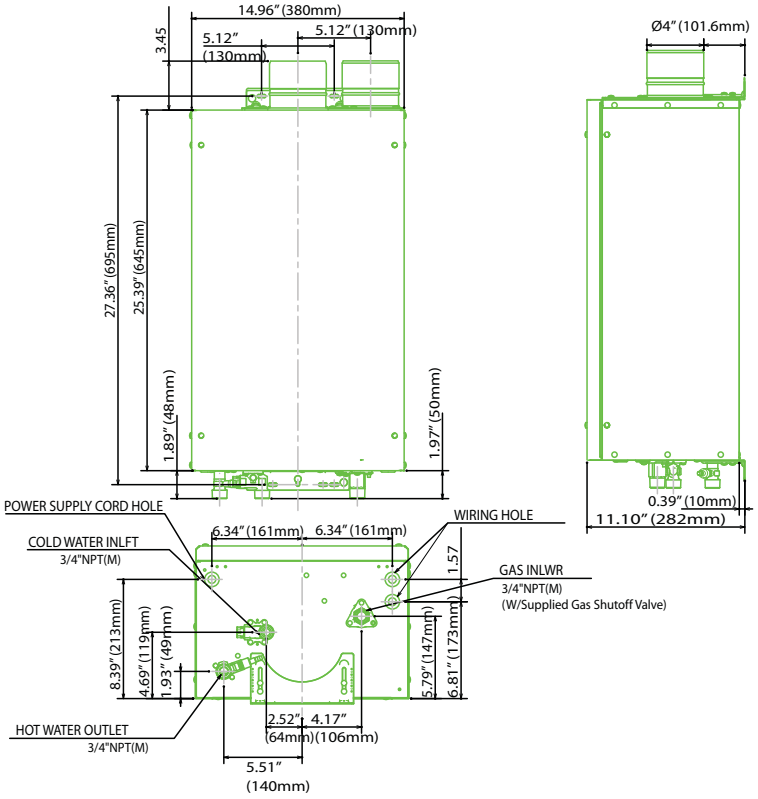


(PH-28ROF & PH-28COF Outdoor Model)

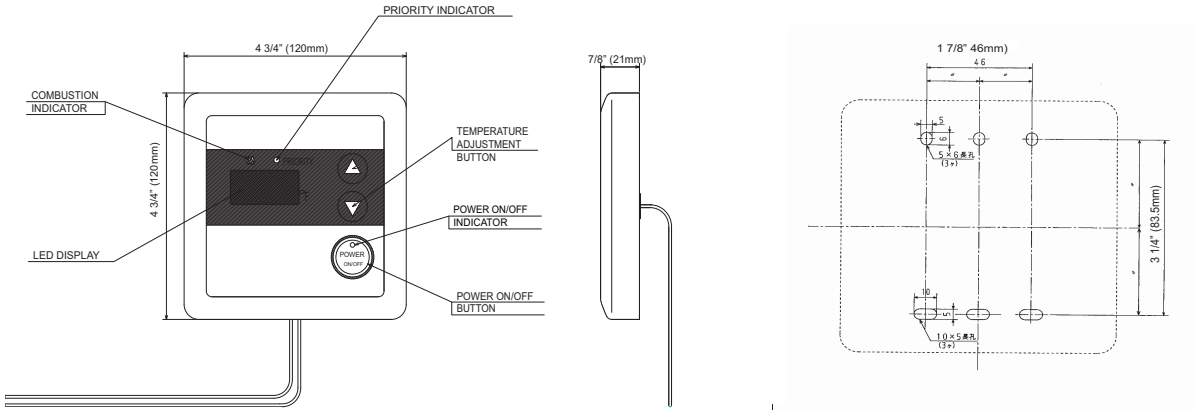


EXTERNAL DIMENSIONS

(PH-28RDVS & PH-28CDVS Direct Vent Model)

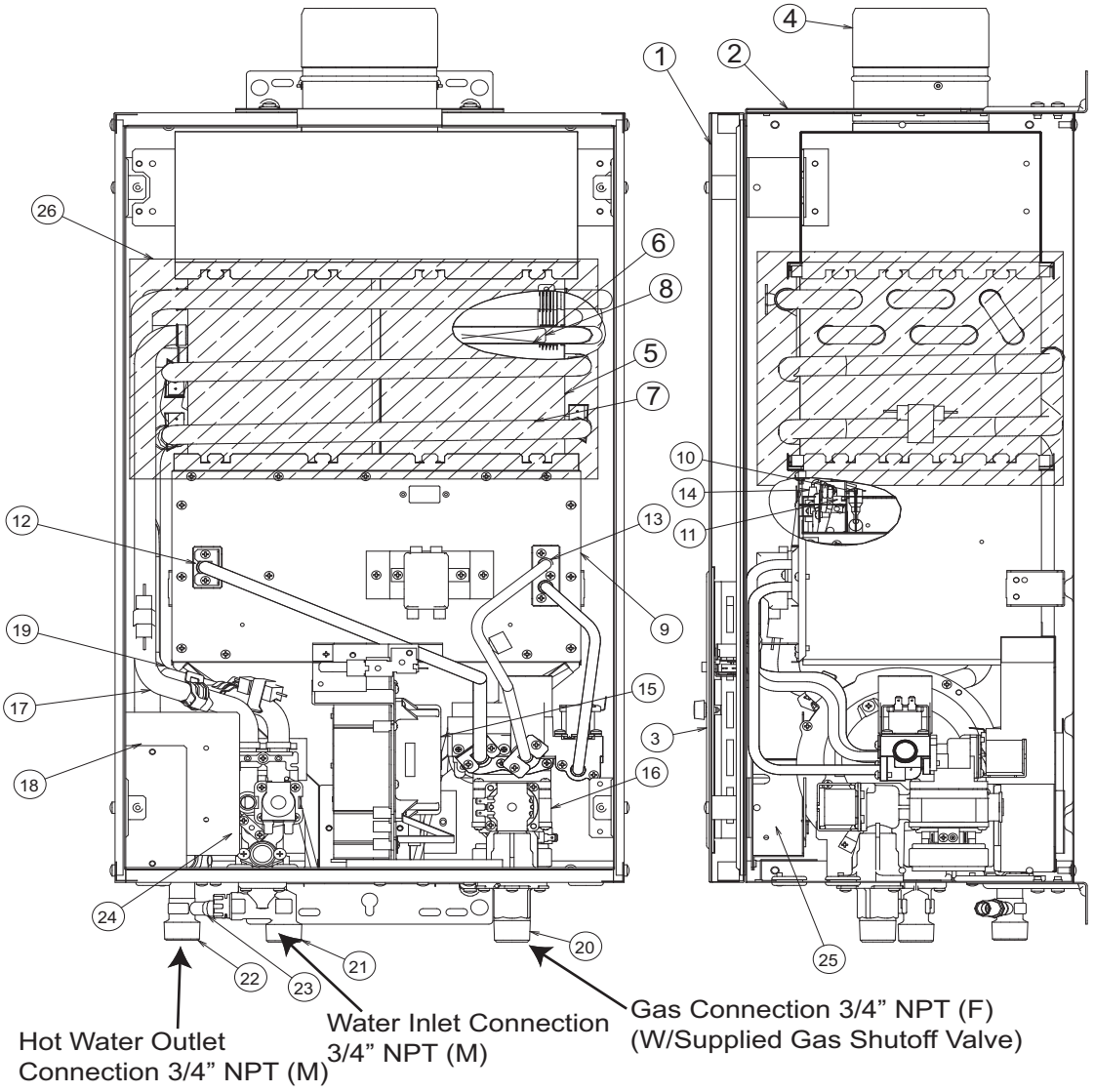


(Remote Control)



SCHEMATIC CONSTRUCTION

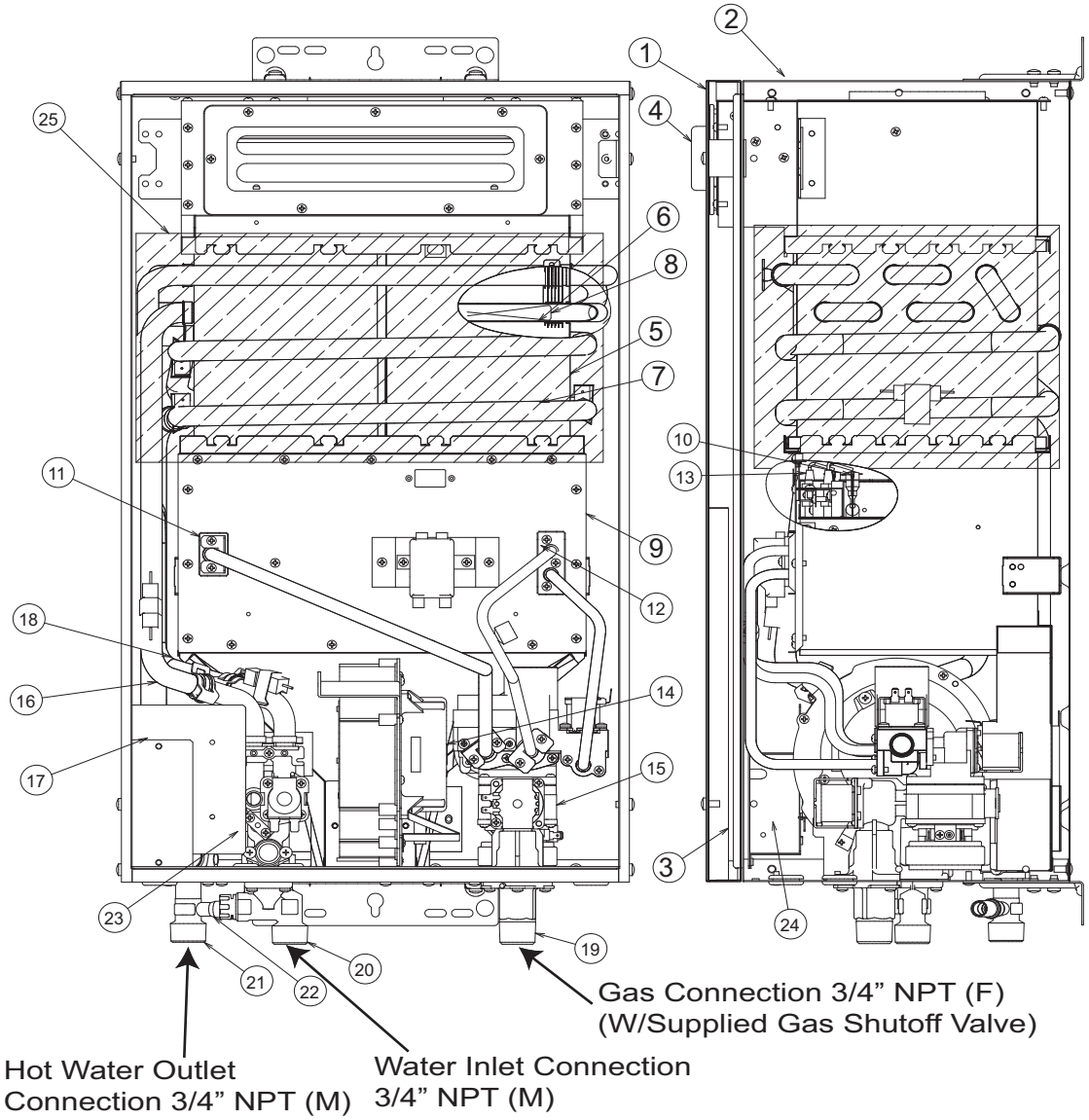
(PH-28RIFS & PH-28CIFS Indoor Model)



No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover	11	Sensing Burner Assembly	21	Water Inlet Connection
2	Back Cover	12	Orifice Stand L Assembly	22	Hot Water Outlet Connection
3	Air Filter Assembly	13	Orifice Stand R Assembly	23	Drain Valve
4	Exhaust Flue Top	14	Electrode	24	Water Control Body Assy.
5	Heat Exchanger	15	Fan Assembly	25	PC Board
6	Heat Transfer Coil	16	Gas Control Valve Assembly	26	Film Type OHL
7	Water Supply Coil	17	Water Supply Pipe		
8	Turbulence Plate	18	Hot Water Supply Pipe		
9	Inner Case	19	Bypass Pipe		
10	Main Burner	20	Gas Connection		

SCHEMATIC CONSTRUCTION

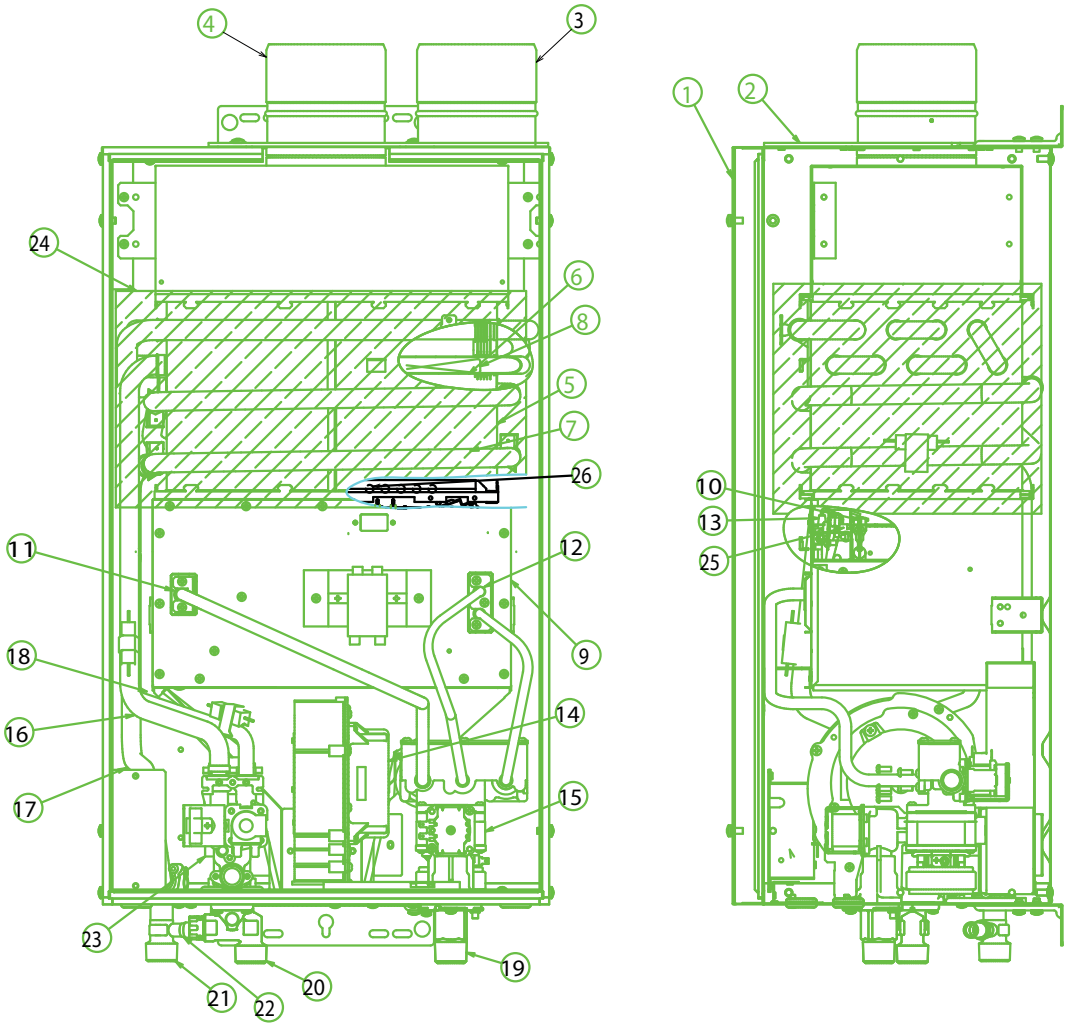
(PH-28ROF & PH-28COF Outdoor Model)



No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover	11	Orifice Stand L Assembly	21	Hot Water Outlet Connection
2	Back Cover	12	Orifice Stand R Assembly	22	Drain Valve
3	Rain Cover	13	Electrode	23	Water Control Body Assy.
4	Flue Outlet	14	Fan Assembly	24	PC Board
5	Heat Exchanger	15	Gas Control Valve Assembly	25	Film Type OHL
6	Heat Transfer Coil	16	Water Supply Pipe		
7	Water Supply Coil	17	Hot Water Supply Pipe		
8	Turbulence Plate	18	Bypass Pipe		
9	Inner Case	19	Gas Connection		
10	Main Burner	20	Water Inlet Connection		

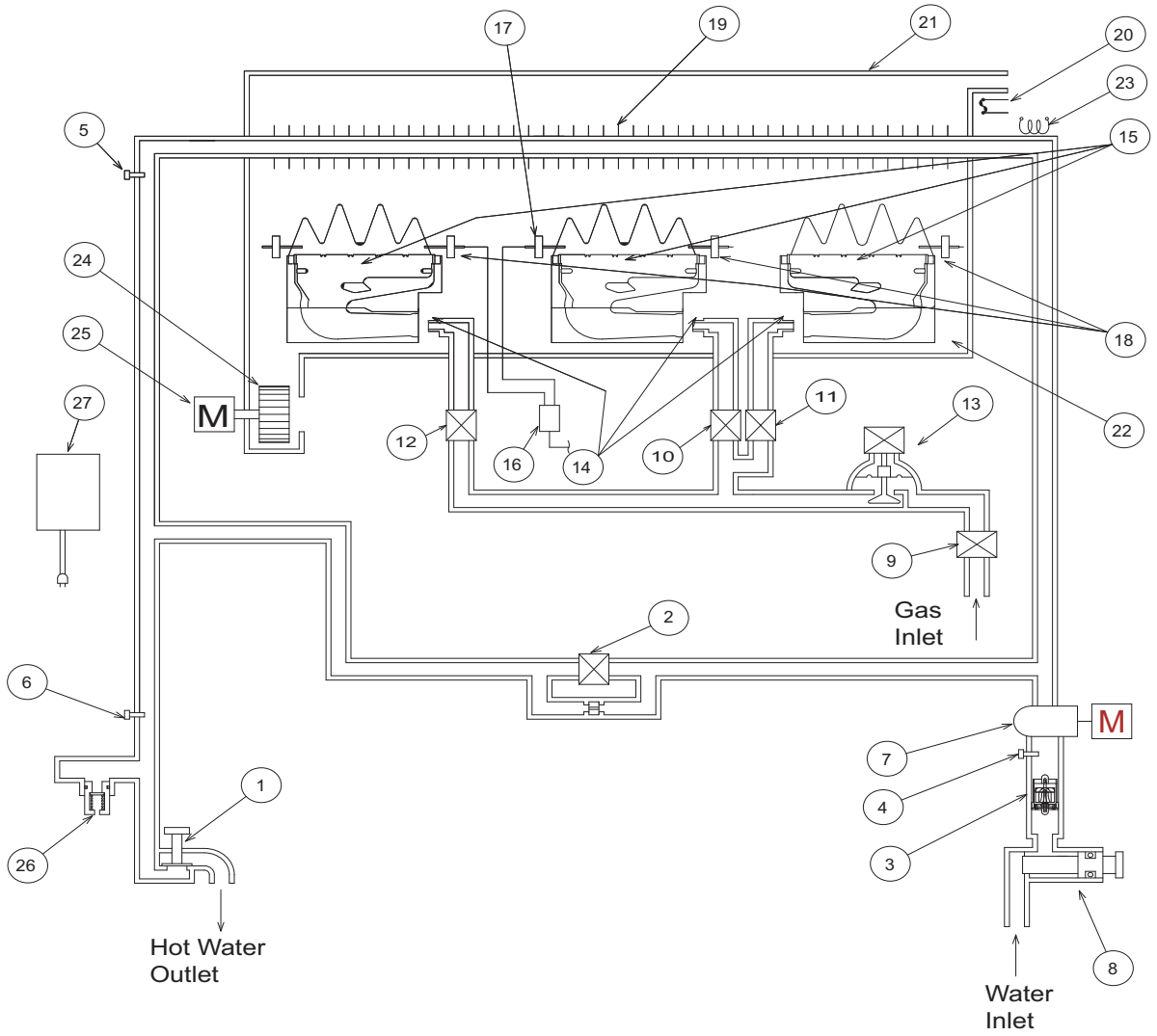
SCHEMATIC CONSTRUCTION

(PH-28RDVS & PH-28CDVS Direct Vent Model)



No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover	11	Orifice Stand L Assembly	21	Hot Water Outlet Connection
2	Back Cover	12	Orifice Stand R Assembly	22	Drain Valve
3	Air Intake	13	Flame Rod	23	Water Control Body Assy.
4	Exhaust Flue Top	14	Fan Assembly	24	Film Type OHL
5	Heat Exchanger	15	Gas Control Valve Assembly	25	Sensing Burner Assembly
6	Heat Transfer Coil	16	Water Supply Pipe	26	Burner Rod
7	Water Supply Coil	17	Hot Water Supply Pipe		
8	Turbulence Plate	18	Bypass Pipe		
9	Inner Case	19	Gas Connection		
10	Main Burner	20	Water Inlet Connection		

OPERATIONAL PRINCIPLE



No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Hot Water Tap	11	Solenoid Valve 2	21	Exhaust Outlet
2	Bypass Solenoid Valve	12	Solenoid Valve 3	22	Combustion Chamber
3	Water Flow Sensor	13	Proportional Gas Control Valve	23	Freeze Protection Heater
4	Water Inlet Thermistor	14	Orifice	24	Fan
5	Heat Exchanger Thermistor	15	Main Burner	25	Fan Motor
6	Hot Water Outlet Thermistor	16	Igniter	26	Drain Valve
7	Water Flow Servo	17	Electrode	27	PC Board
8	Water Filter	18	Flame Rod		
9	Gas Inlet Solenoid Valve	19	Heat Exchanger		
10	Solenoid Valve 1	20	Film Type OHL		

OPERATIONAL PRINCIPLE

WHEN SUPPLYING HOT WATER

1) By opening the Hot Water Top (1), the water flows through the Water Flow Sensor (3) to the Heat Heat Exchanger (19).

2) The frequency signal is given from the Water Flow Sensor (3) and when the PC Board (27) senses the signal that reached a certain frequency, the Fan (24) starts to turn round.

3) After the Fan (24) turned round and pre-purged, the Gas Inlet Solenoid Valve (9), Solenoid Valve 1 (10) and Solenoid Valve 2 (11) open at the same time. Then, the Proportional Gas Control Valve (13) becomes an ignition motion and allows the gas to flow to the Main Burner (15) (and Sensing Burner for PH-28RIFS, PH-28CIFS, PH-28RDVS and PH-28CDVS only).

4) At the same time, the Igniter (16) continuously makes sparks and ignites the Main Burner (15). After ignited, when the Flame Rod (18) senses the flame and make sure the combustion, the Proportional Gas Control Valve (13) finishes the ignition motion.

5) After finished the ignition motion, the proportional gas control is started. When there is a temperature difference between the hot water temperature that is sensed by the Hot Water Outlet Thermistor (6) and the set temperaturer on the Remote Control, the PC Board (27) judges it and open or close the Solenoid Valve 1 (10), Solenoid Valve 2 (11) and Solenoid Valve 3 (12), and also the Proportional Gas Control Valve (13) continuously adjusts the gas volume in order to maintain the outlet temperature from the Heat Exchanger (19).
The Water Flow Servo (7) also adjusts the proper amount of water flow to supply a stable hot water temperature at all times.

6) According to the adjustment of the gas volume by the Proportional Gas Control Valve (13), a signal from the PC Board (27) is also sent to the Fan Motor (25) in order to maintain the relation between the gas volume and air volume at all times.

7) (For PH-28RIFS, PH-28CIFS, PH-28RDVS and PH-28CDVS only) When the air intake or venting is blocked, or the oxygen of the air intake is not sufficient, the output of the Thermocouple that is located at the Sensing Burner would be changed. The PC Board (27) senses this change and controls the Fan (24), Proportional Gas Control Valve (13), etc. in order to prevent the imperfect combustion. Further, if such condition is proceeded, it shuts off the Gas Inlet Solenoid Valve (9), Solenoid Valve 1 (10), Solenoid Valve 2 (11), Solenoid Valve 3 (12) and Proportional Gas Control Valve (13) in order to stop the operation.

8) When the Hot Water Tap (1) is closed, the frequency signal from the Water Flow Sensor (3) is stopped and the Gas Inlet Solenoid Valve (9), Solenoid Valve 1 (10), Solenois Valve 2 (11), Solenoid Valve 3 (12) and Proportional Gas Control Valve (13) turn off and becomes a post-purge motion.

9) When the time of the post-purge is up, the Fan (24) stops.

Oxygen Depletion Safety Device (O.D.S.D.)

[Sensing Burner]

(Indoor Model & Direct Model Only)

The sensing burner is a all primary air type ceramic burner that consists of an outer jacket surrounding the flame opening and a thermocouple to detect flame temperature. In case oxygen level decreases due to blocked or clogged air intake or flue venting, or by contaminated air, location of the flame will change as well as its temperature by the thermocouple. The sensing burner is located in the part of the main burner and designed to monitor the flame condition at all times. Therefore, it shut off gas before the imperfect combustion occurs in the main burner.

NORMAL

BLOCKING

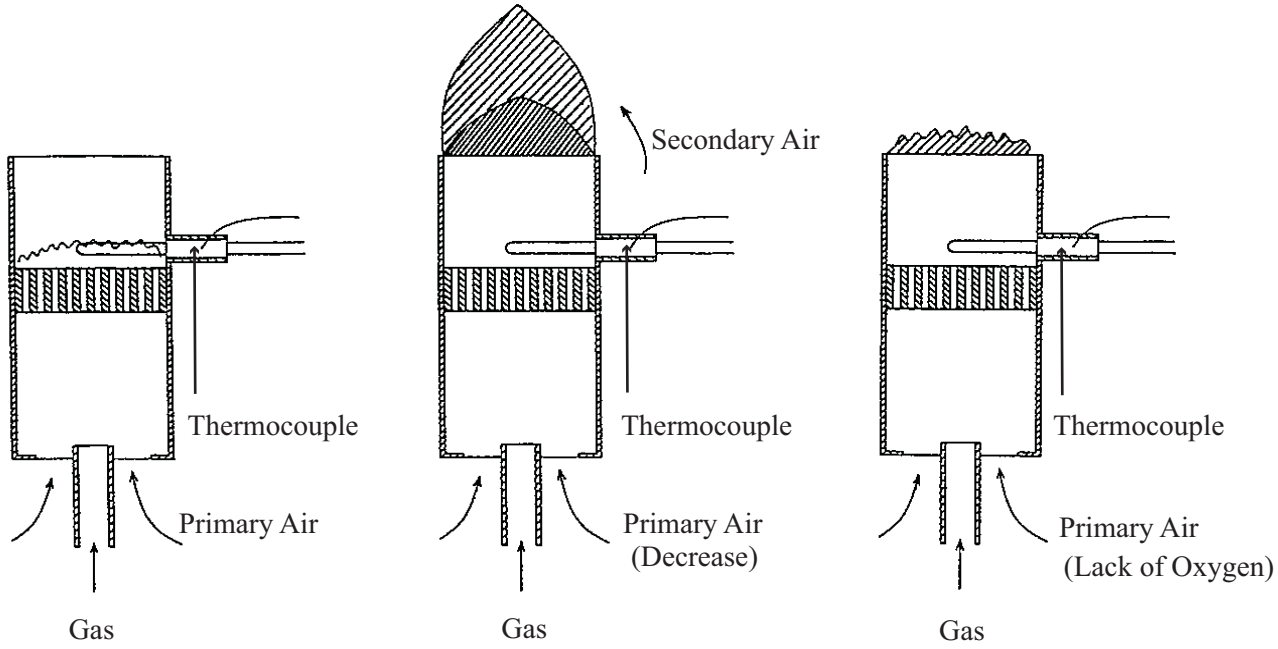
The flame lifts away from the thermocouple.

(Blocked or clogged vent, fan etc.)

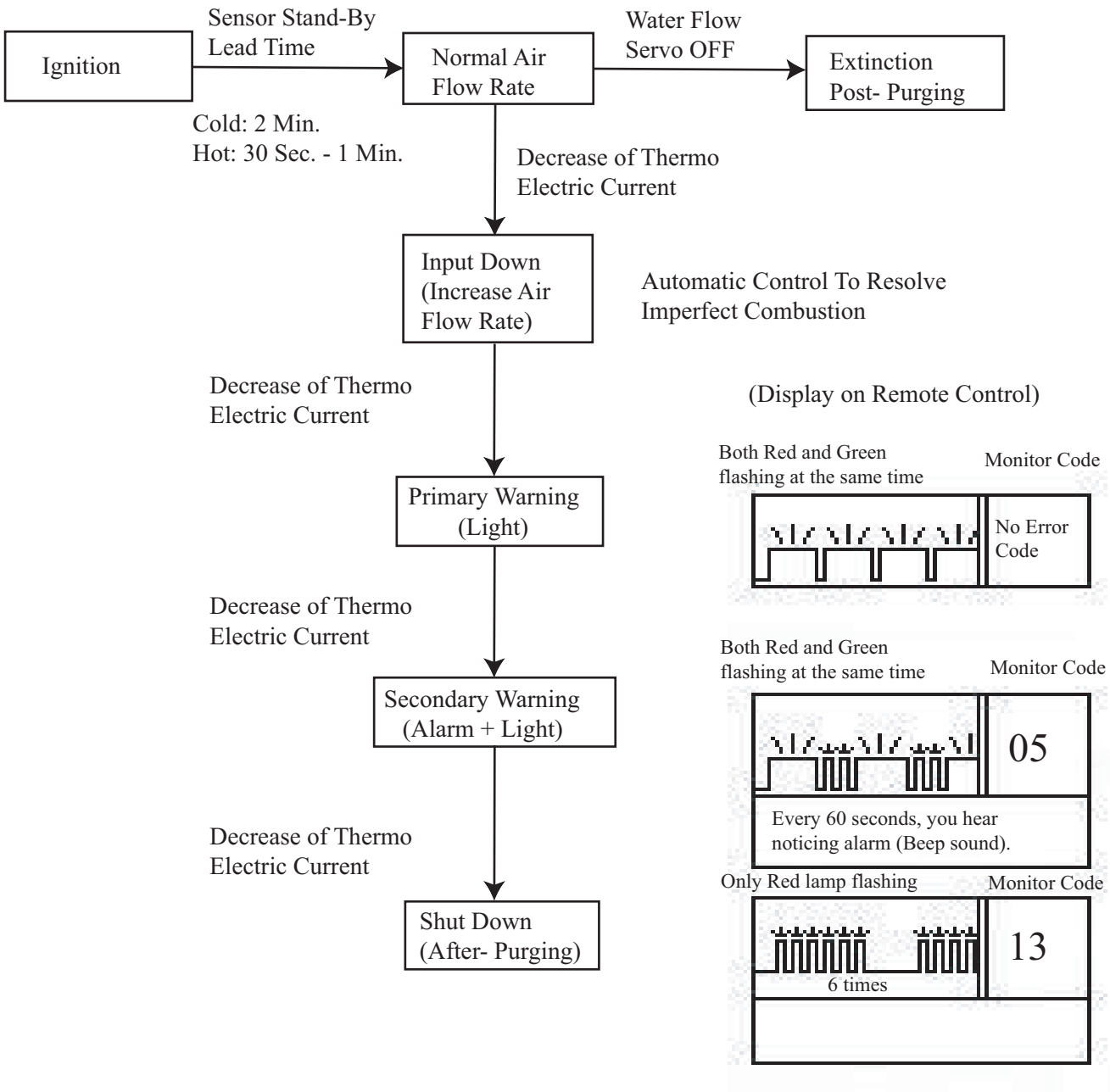
LACK OF OXYGEN

The flame lifts away from the thermocouple.

(Contaminated air in room, etc.)



If Imperfect Combustion Happens..... (Indoor Model & Direct Model Only)

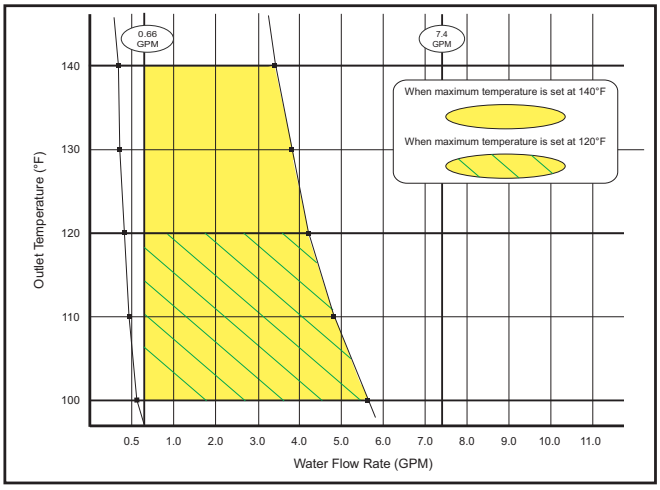


NOTE: Shutdown by impeefect combustion can be reset by pressing power switch (ON/OFF Button).
However, if it occurs 5 times within 4 hours, the water heater will not recover for the next 4 hours.

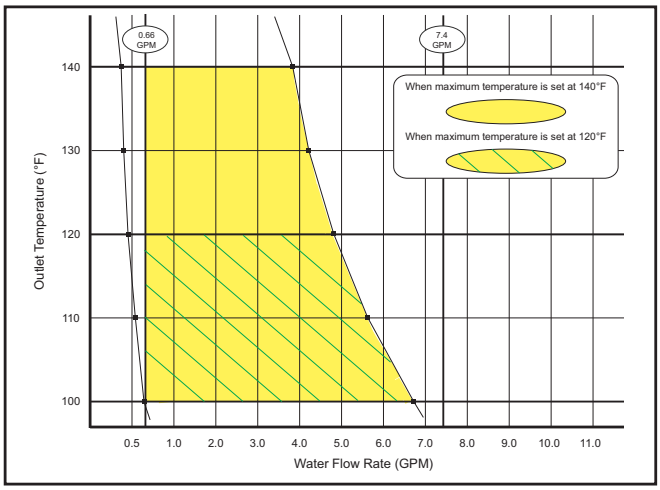
Capacity

Hot Water Capacity Curve: Residential Models

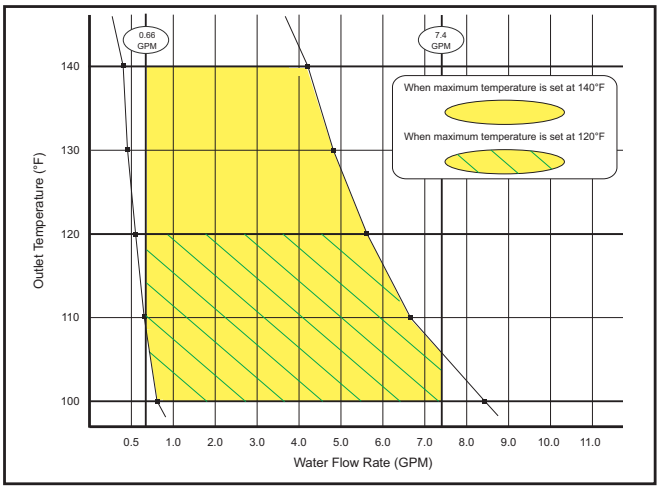
Inlet Water Temperature : 40°F



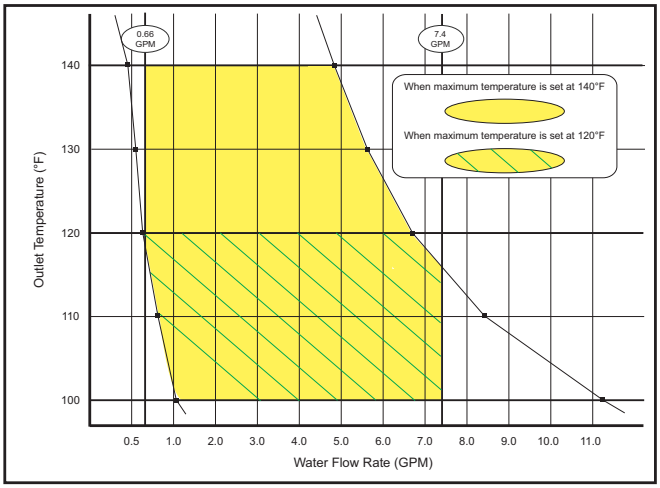
Inlet Water Temperature : 50°F



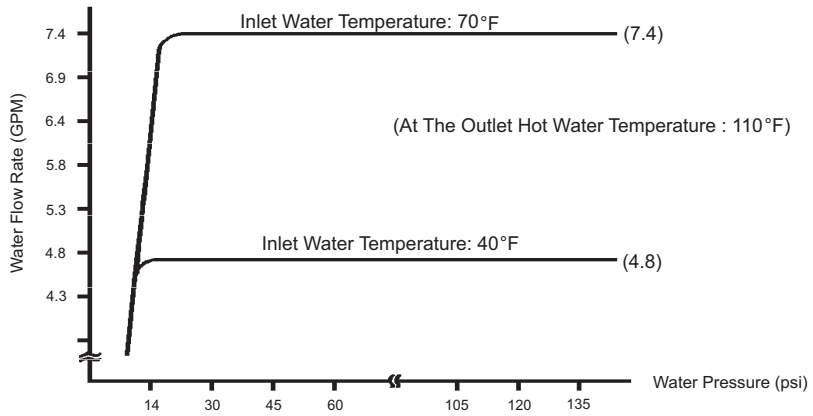
Inlet Water Temperature : 60°F



Inlet Water Temperature : 70°F



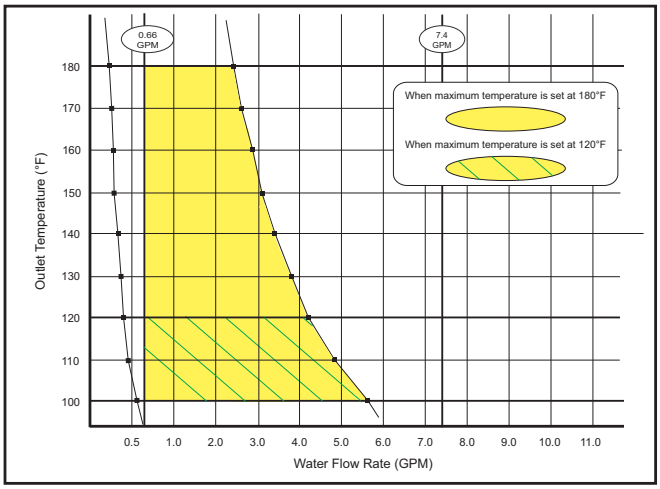
Water Pressure & Water Flow Rate:



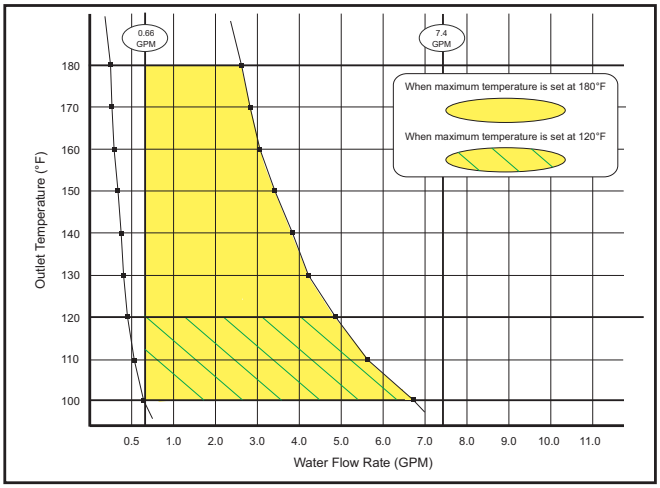
Capacity

Hot Water Capacity Curve: Commercial Models

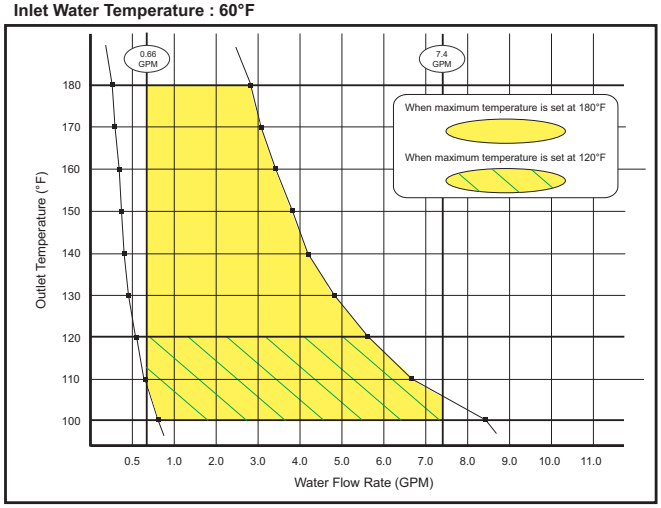
Inlet Water Temperature : 40°F



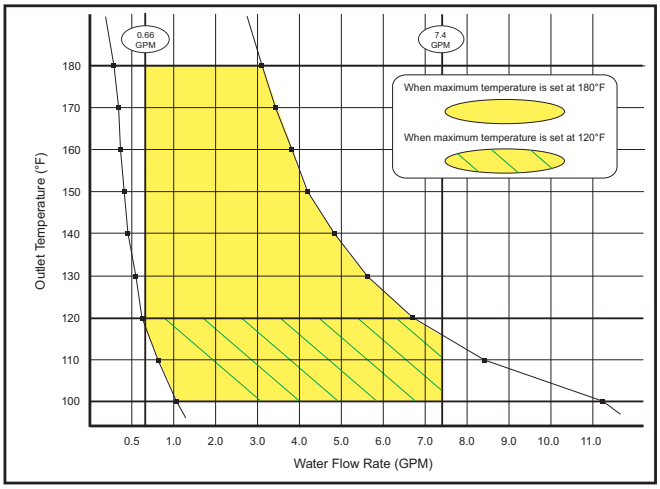
Inlet Water Temperature : 50°F



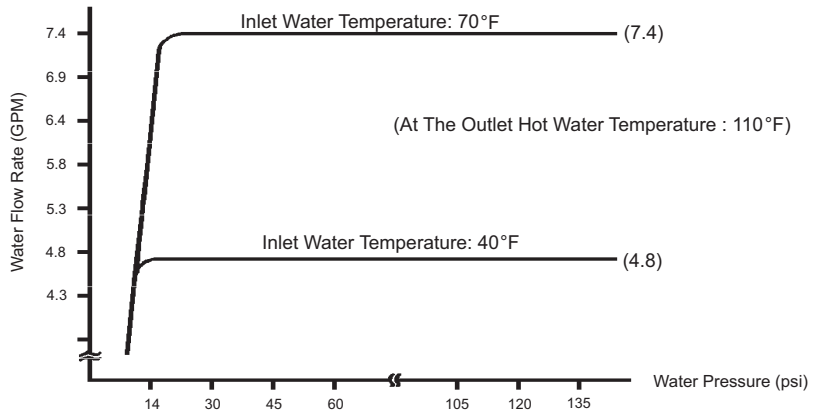
Inlet Water Temperature : 60°F



Inlet Water Temperature : 70°F

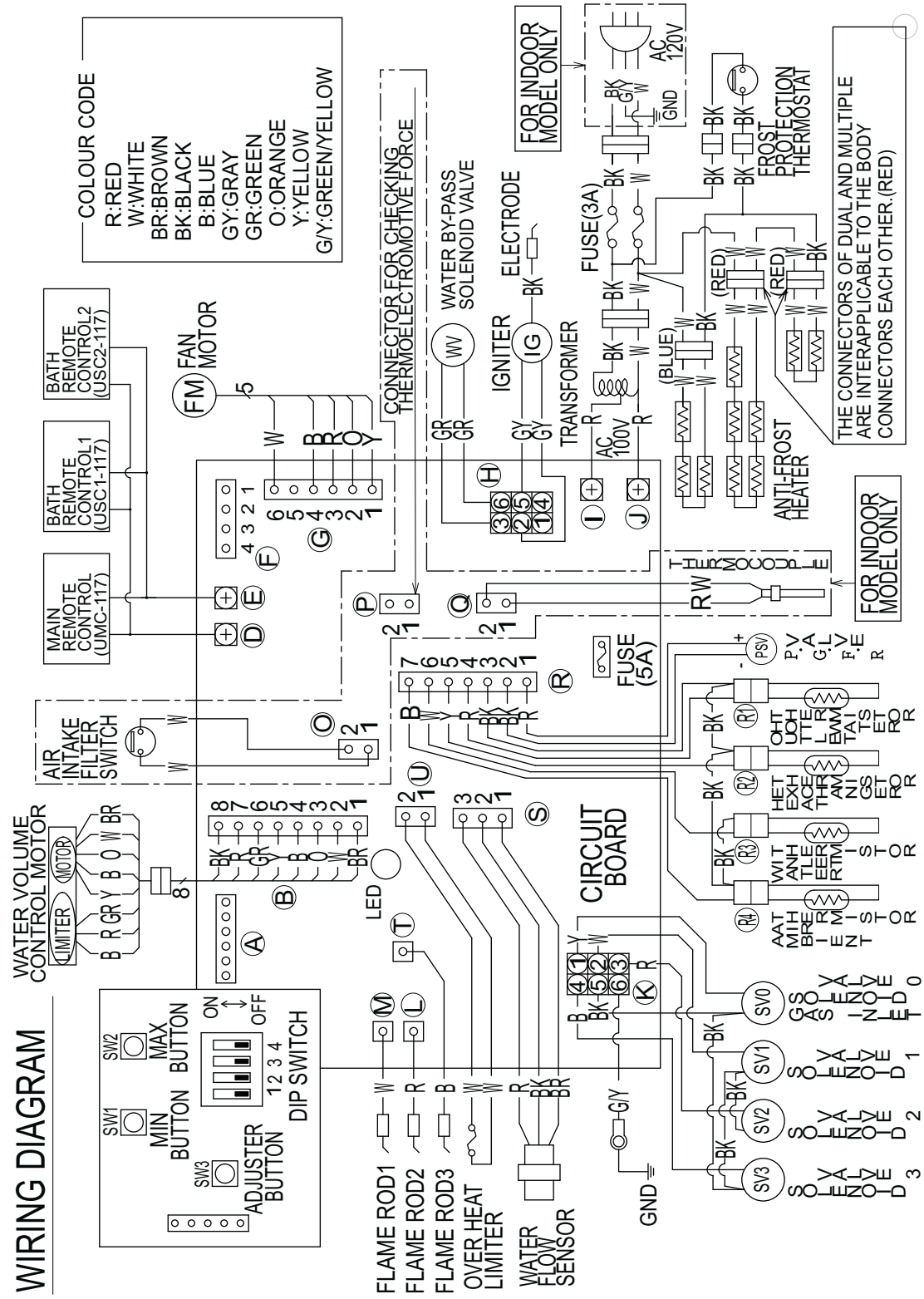


Water Pressure & Water Flow Rate:

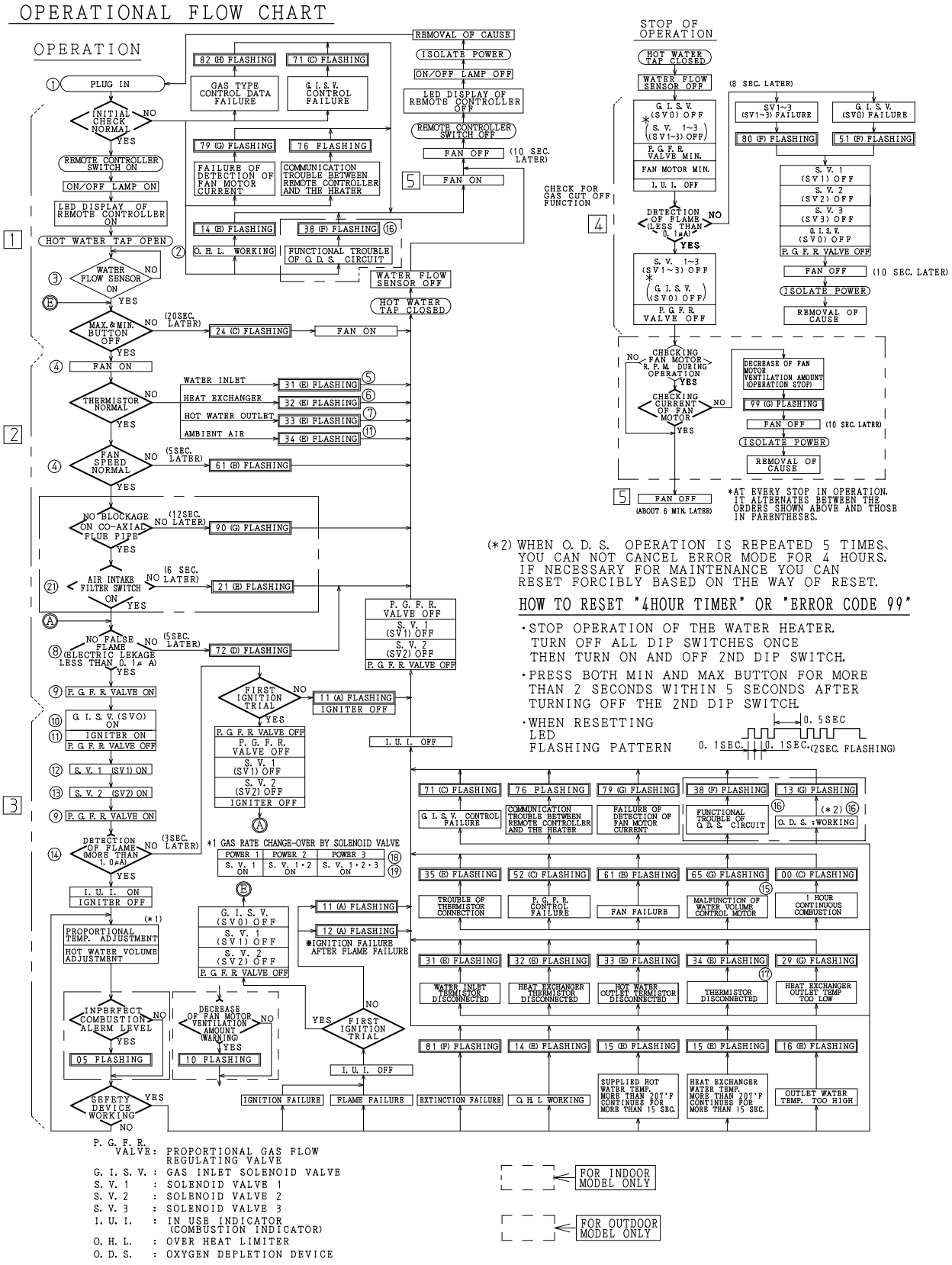


Wiring Diagram

A wiring diagram is also located on the inside of the front cover panel.
Slightly different by model and serial number.



Operational Flow Chart & Maintenance Information


OPERATIONAL FLOW CHART
OPERATION
PLUG IN
INITIAL CHECK NORMAL
REMOTE CONTROLLER SWITCH ON
ON/OFF LAMP ON
LED DISPLAY OF REMOTE CONTROLLER ON
HOT WATER TAP OPEN
WATER FLOW SENSOR ON
MAX. & MIN. BUTTON OFF
FAN ON
THERMISTOR NORMAL
FAN SPEED NORMAL
NO BLOCKAGE ON CO-AXIAL FLUE PIPE
AIR INTAKE FILTER SWITCH ON
NO FALSE FLAME (ELECTRIC LEKAGE LESS THAN 0.1μA)
P.G.F.R. VALVE ON
G.I.S.V.(SV0) ON
IGNITER ON
P.G.F.R. VALVE OFF
S.V.1 (SV1) ON
S.V.2 (SV2) ON
P.G.F.R. VALVE ON
DETECTION OF FLAME (MORE THAN 1.0μA)
I.U.I. ON IGNITER OFF
PROPORTIONAL TEMP. ADJUSTMENT
HOT WATER VOLUME ADJUSTMENT
INPERFECT COMBUSTION ALERM LEVEL
05 FLASHING
SEFETY DEVICE WORKING
82 (H) FLASHING
71 (C) FLASHING
GAS TYPE CONTROL DATA FAILURE
G.I.S.V. CONTROL FAILURE
79 (G) FLASHING
76 FLASHING
FAILURE OF DETECTION OF FAN MOTOR CURRENT
COMMUNICATION TROUBLE BETWEEN REMOTE CONTROLLER AND THE HEATER
14 (E) FLASHING
38 (F) FLASHING
O.H.L. WORKING
FUNCTIONAL TROUBLE OF O.D.S. CIRCUIT
REMOVAL OF CAUSE
ISOLATE POWER
ON/OFF LAMP OFF
LED DISPLAY OF REMOTE CONTROLLER OFF
REMOTE CONTROLLER SWITCH OFF
FAN OFF (10 SEC. LATER)
FAN ON
WATER FLOW SENSOR OFF
HOT WATER TAP CLOSED
24 (C) FLASHING
WATER INLET
HEAT EXCHANGER
HOT WATER OUTLET
AMBIENT AIR
31 (E) FLASHING
32 (E) FLASHING
33 (E) FLASHING
34 (E) FLASHING
61 (E) FLASHING
90 (G) FLASHING
21 (E) FLASHING
72 (C) FLASHING
11 (A) FLASHING
IGNITER OFF
P.G.F.R. VALVE OFF
S.V.1 (SV1) OFF
S.V.2 (SV2) OFF
I.U.I. OFF
*1 GAS RATE CHANGE-OVER BY SOLENOID VALVE
POWER 1 / POWER 2 / POWER 3
S.V.1 ON / S.V.1・2 ON / S.V.1・2・3 ON
G.I.S.V.(SV0) OFF
12 (A) FLASHING
*IGNITION FAILURE AFTER FLAME FAILURE
DECREASE OF FAN MOTOR VENTILATION AMOUNT (WARNING)
10 FLASHING
FIRST IGNITION TRIAL
IGNITION FAILURE
FLAME FAILURE
EXTINCTION FAILURE
O.H.L. WORKING
STOP OF OPERATION
HOT WATER TAP CLOSED
WATER FLOW SENSOR OFF
G.I.S.V. (SV0) OFF
S.V. 1~3 (SV1~3) OFF
P.G.F.R. VALVE MIN.
FAN MOTOR MIN.
I.U.I. OFF
CHECK FOR GAS CUT OFF FUNCTION
DETECTION OF FLAME (LESS THAN 0.1μA)
S.V. 1~3 (SV1~3) OFF
G.I.S.V. (SV0) OFF
P.G.F.R. VALVE OFF
FAN OFF (ABOUT 6 MIN. LATER)
(8 SEC. LATER)
SV1~3 (SV1~3) FAILURE
G.I.S.V. (SV0) FAILURE
80 (F) FLASHING
51 (F) FLASHING
S.V. 1 (SV1) OFF
S.V. 2 (SV2) OFF
S.V. 3 (SV3) OFF
G.I.S.V. (SV0) OFF
P.G.F.R VALVE OFF
FAN OFF (10 SEC. LATER)
ISOLATE POWER
REMOVAL OF CAUSE
CHECKING FAN MOTOR R.P.M. DURING OPERATION
CHECKING CURRENT OF FAN MOTOR
DECREASE OF FAN MOTOR VENTILATION AMOUNT (OPERATION STOP)
99 (G) FLASHING
FAN OFF (10 SEC. LATER)
ISOLATE POWER
REMOVAL OF CAUSE
*AT EVERY STOP IN OPERATION, IT ALTERNATES BETWEEN THE ORDERS SHOWN ABOVE AND THOSE IN PARENTHESES.
(*2) WHEN O.D.S. OPERATION IS REPEATED 5 TIMES, YOU CAN NOT CANCEL ERROR MODE FOR 4 HOURS. IF NECESSARY FOR MAINTENANCE YOU CAN RESET FORCIBLY BASED ON THE WAY OF RESET.
HOW TO RESET "4HOUR TIMER" OR "ERROR CODE 99"
・STOP OPERATION OF THE WATER HEATER. TURN OFF ALL DIP SWITCHES ONCE THEN TURN ON AND OFF 2ND DIP SWITCH.
・PRESS BOTH MIN AND MAX BUTTON FOR MORE THAN 2 SECONDS WITHIN 5 SECONDS AFTER TURNING OFF THE 2ND DIP SWITCH.
・WHEN RESETTING LED FLASHING PATTERN
0.5SEC
0.1SEC.
0.1SEC.(2SEC. FLASHING)
71 (C) FLASHING
G.I.S.V. CONTROL FAILURE
76 FLASHING
COMMUNICATION TROUBLE BETWEEN REMOTE CONTROLLER AND THE HEATER
79 (G) FLASHING
FAILURE OF DETECTION OF FAN MOTOR CURRENT
38 (F) FLASHING
FUNCTIONAL TROUBLE OF O.D.S. CIRCUIT
13 (G) FLASHING
O.D.S. :WORKING
35 (E) FLASHING
TROUBLE OF THERMISTOR CONNECTION
52 (C) FLASHING
P.G.F.R. CONTROL FAILURE
61 (E) FLASHING
FAN FAILURE
65 (G) FLASHING
MALFUNCTION OF WATER VOLUME CONTROL MOTOR
00 (C) FLASHING
1 HOUR CONTINUOUS COMBUSTION
31 (E) FLASHING
WATER INLET THERMISTOR DISCONNECTED
32 (E) FLASHING
HEAT EXCHANGER THERMISTOR DISCONNECTED
33 (E) FLASHING
HOT WATER OUTLET THERMISTOR DISCONNECTED
34 (E) FLASHING
THERMISTOR DISCONNECTED
29 (G) FLASHING
HEAT EXCHANGER OUTLET TEMP TOO LOW
81 (F) FLASHING
14 (E) FLASHING
15 (E) FLASHING
SUPPLIED HOT WATER TEMP. MORE THAN 207°F CONTINUES FOR MORE THAN 15 SEC.
15 (E) FLASHING
HEAT EXCHANGER WATER TEMP. MORE THAN 207°F CONTINUES FOR MORE THAN 15 SEC.
16 (E) FLASHING
OUTLET WATER TEMP. TOO HIGH
FOR INDOOR MODEL ONLY
FOR OUTDOOR MODEL ONLY

P.G.F.R. VALVE: PROPORTIONAL GAS FLOW REGULATING VALVE
G.I.S.V. : GAS INLET SOLENOID VALVE
S.V. 1 : SOLENOID VALVE 1
S.V. 2 : SOLENOID VALVE 2
S.V. 3 : SOLENOID VALVE 3
I.U.I. : IN USE INDICATOR (COMBUSTION INDICATOR)
O.H.L. : OVER HEAT LIMITER
O.D.S. : OXYGEN DEPLETION DEVICE

Diagnostic Points

DIAGNOSTIC POINTS

*1 Approximate figure measured by common digital tester (DC RANGE).
*2 Approximate figure measured by common digital tester (AC RANGE).

Flow NO.	CN	Measurement Point wire& color	Diagnosis (Normal Value)	Point To Check
①	I・J	—	AC90~110V	MAIN POWER IS NORMAL?
②	U	W 1 — W 2	50K~500KΩ	O. H. L. IS OKAY?
③	S	BR 1 — BK 2	DC2~5V (PULSE) *1 MORE THAN 1310PURSE/M	WATER FLOW SENSOR IS PRODUCING A REGULAR PULSE?
		R 3 — BK 2	DC11~17V	WATER FLOW SENSOR HAS NORMAL VOLTAGE?
④	G	B 4 — W 6	DC120~160V	FAN MOTOR HAS PROPER VOLTAGE?
		R 3 — B 4	DC12~18V	FAN MOTOR HAS PROPER VOLTAGE?
		Y 1 — B 4	DC4~10V (PULSE) *1 MORE THAN 4800PURSE/M	FAN MOTOR IS PRODUCING A REGULAR PULSE?
⑤	R	W 6 — BK 3	20℃ 10. 3KΩ 40℃ 4. 9KΩ	WATER INLET THERMISTOR IS NORMAL?
⑥	R	Y 5 — BK 3	20℃ 10. 3KΩ 40℃ 4. 9KΩ	HEAT EXCHANGER THERMISTOR IS NORMAL?
⑦	R	R 4 — BK 3	20℃ 10. 3KΩ 40℃ 4. 9KΩ	HOT WATER OUTLET THERMISTOR IS NORMAL?
⑧	L	R 1 — GND	AC0. 3~100V *2	FLAME ROD IS NOT DETECTING FLAME?
	M	W 1 — GND	AC0. 3~100V *2	
	T	B 1 — GND	AC0. 5~100V *2	
⑨	R	R 1 — BK 2	DC1. 5~14. 0V 40~80Ω	P. G. F. R. VALVE IS NORMAL?

Flow NO.	CN	Measurement Point wire& color	Diagnosis (Normal Value)	POINT TO CHECK
⑩	K	Y 1 — BK 5	DC75~100V 0. 8~2. 2KΩ	GAS INLET SOLENOID VALVE IS OKAY?
⑪	H	GY 2 — GY 5	AC90~110V	THE IGNITER IS FUNCTIONING CORRECTLY?
⑫	K	W 2 — BK 5	DC75~100V 0. 8~2. 2KΩ	SOLENOID VALVE 1 IS OKAY?
⑬	K	R 3 — BK 5	DC75~100V 0. 8~2. 2KΩ	SOLENOID VALVE 2 IS OKAY?
⑱	K	R 4 — BK 5	DC75~100V 0. 8~2. 2KΩ	SOLENOID VALVE 3 IS OKAY?
⑭	L	R 1 — GND	AC1~100V *2	FLAME ROD IS DETECTING FLAME?
	M	W 1 — GND	AC1~100V *2	
⑲	T	B 1 — GND	AC1~100V *2	
⑮	B	W 2 — BK 8	DC8~16V	WATER VOLUME CONTROL MOTOR HAS PROPER VOLTAGE
		R 7 — BK 8	DC8~16V	WATER VOLUME CONTROL MOTOR HAS PROPER VOLTAGE
		GR 6 — BK 8	Less Than DC1V (LIMITER ON) DC4~6V (LIMITER OFF)	WATER VOLUME CONTROL MOTOR POSITION SWITCH IS NORMAL
⑯	Q	R 1 — W 2	DC8~10mV (AFTER 2 MINUTES LATER FROM COMBUSTION START)	THERMOELECTROMOTIVE FORCE IS OKAY?
⑯	P	1 — 2	DC0. 8~3V (AFTER 2 MINUTES LATER FROM COMBUSTION START)	THERMOELECTROMOTIVE FORCE IS OKAY?
⑰	R	B 7 — BK 3	20℃ 10. 3KΩ 40℃ 4. 9KΩ	AMBIENT AIR THERMISTOR IS NORMAL?
㉑	O	W 1 — W 2	LESS THAN DC1V LESS THAN 1Ω	AIR INTAKE FIMTER SWITCH IS OKAY?

The voltage showed is the value of operating condition when the water heater operates according to the flow chart.
The resistance showed is the value of load side when turned off the electric power and disconnected the connector.

ERROR CODE	LED	DESCRIPTION	POINT TO CHECK
00	C	1 HOUR CONTINUOUS COMBUSTION	
05	—	IMPERFECT CONBUSTION ALERM	HEAT EXCHANGER, FAN, CLEANESS OF AIR INLET, ROOM VERTILATION
05	—	HEAT EXCHANGER OUTLET TEMP ALARM (TOO LOW)	HEAT EXCHANGER, CLEANESS OF AIR INLET
10	—	DECREASE OF FAN MOTOR VENTILATION AMOUNT (WARNING)	CLEAN ANY BLOCKAGE IN HEAT EXCHANGER FINS. FAN, AIR INTAKE
11	A	IGNITION FAILURE	P. G. F. R VALVE⑨, GAS INLET SOLENOID VALVE⑩ IGNITER ⑪, SOLENOID VALVE 1・2・3 ⑫⑬⑱ FLAME ROD1・2・3 ⑭⑲
12	A	FLAME FAILURE	P. G. F. R VALVE⑨, GAS INLET SOLENOID VALVE⑩ SOLENOID VALVE 1・2・3⑫⑬⑱ FLAME ROD1・2・3⑭⑲
13	G	O. D. S. WORKING	HEAT EXCHANGER, FAN, CLEANESS OF AIR INLET ROOM VERTILATION, THERMOCOUPLE ⑯
14	E	OVER HEATING	O. H. L. ②
15	E	BOILING SAFETY DEVICE EMPTY BOILING SAFETY DEVICE	HOT WATER OUTLET THERMISTOR ⑦ HEAT EXCHANGER THERMISTOR⑥
16	E	OUTLET WATER TEMP. TOO HIGH	P. G. F. R VALVE ⑨
21	E	MALFUNCTION OF AIR INTAKE FILTER SWITCH	AIR INTAKE FILTER SWITCH⑳
24	C	MALFUNCTION OF OPERATIONAL SWITCH	MAX. BUTTON, MIN BUTTON
29	G	HEAT EXCHANGER OUTLET TEMP. TOO LOW	HEAT EXCHANGER, CLEANESS OF AIR INLET
31	E	WATER INLET THERMISTOR DISCONNECTED	WATER INLET THERMISTOR ⑤
32	E	HEAT EXCHANGER THERMISTOR DISCONNECTION	HEAT EXCHANGER THERMISTOR ⑥
33	E	HOT WATER OUTLET THERMISTOR DISCONNECTION	HOT WATER OUTLET THERMISTOR ⑦
34	E	AMBIENT AIR THERMISTOR DISCONNECTED・SHORT CIRCUIT	AMBIENT AIR THERMISTOR ⑰
35	E	TROUBLE OF THERMISTOR CONNECTION	WRONG CONNECTION OF THERMISTORS
38	F	MALFUNCTION OF O. D. S. CIRCUIT	CIRCUIT BOARD ⑯
51	F	GAS INLET SOLENOID VALVE FAILURE	GAS INLET SOLENOID VALVE⑩, FLAME ROD 1・2・3 ⑭⑲
52	C	P. G. F. R. CONTROL FAILURE	P. G. F. R VALVE⑨ CIRCUIT BOARD
61	B	FAN FAILURE	FAN MOTOR ④
65	G	MALFUNCTION OF WATER VOLUME CONTROL MOTOR	WATER VOLUME CONTROL MOTOR ⑮
71	C	G. I. S. V. CONTROL FAILURE	GAS INLET SOLENOID VALVE ⑩ CIRCUIT BOARD
72	D	DETECTED FALSE FLAME	FLAME ROD 1・2 ⑧
76	—	COMMUNICATION TROUBLE BETWEEN REMOTE CONTROLLER AND THE HEATER	REMOTE CONTROLLER, CIRCUIT BOARD, REMOTE CONTROLLER CABLES
79	G	FAILURE OF DETECTION OF FAN MOTOR CURRENT	CIRCUIT BOARD, FAN MOTOR ④
80	F	GAS CUT-OFF FUNCTION DEFECTIVE (SOLENOID VALVE 1~3 FAILURE)	SOLENOID VALVE1・2・3 ⑫⑬⑱ FLAME ROD 1・2・3 ⑭⑲
81	F	EXTINCTION FAILURE (SOLENOID VALVE 1~3 FAILURE)	SOLENOID VALVE1・2・3 ⑫⑬⑱ FLAME ROD 1・2・3 ⑭⑲
82	H	GAS TYPE CONTROL DATA FAILURE	CIRCUIT BOARD, GAS TYPE SETTING FAILURE
90	G	BLOCKAGE ON CO-AXIAL FLUE PIPE	HEAT EXCHANGER, FAN, CLEANESS OF AIR INLET
99	G	DECREASE OF FAN MOTOR VENTILATION AMOUNT (OPERATION STOP)	CLEAN ANY BLOCKAGE IN HEAT EXCHANGER FINS. FAN, AIR INTAKE

TEST POINT GAS PRESSURE SETTING

LOW PRESSURE

1. OPEN THE HOT WATER TAP TO ALLOW MINIMUM OPERATING WATER PRESSURE.
2. PRESS ADJUSTER BUTTON THEN "LH" IS SHOWN IN LED OF REMOTE CONTROLLER
3. PRESS MIN BUTTON WITH THE ADJUSTER BUTTON PRESSED. CURRENT FIGURE 01 TO 39 IS SHOWN IN LED OF REMOTE CONTROLLER
4. YOU CAN CHANGE TEST POINT GAS PRESSURE BY PRESSING THE MIN BUTTON WITH THE ADJUSTER BUTTTON PRESSED.

(EX.) EVERY TIME YOU PRESS THE MIN BUTTON, DISPLAY NUMBER CHANGES AS FOLLOWS.

01 → 02 → 03 → ····· → 37 → 38 → 39 → 02 ← 03 ····· ← 37 ← 38 ← 39

5. DETACH FROM THE MIN BUTTON AND THEN FROM THE ADJUSTER BUTTON IN THIS ORDER.

HIGH PRESSURE

1. FULLY OPEN THE HOT WATER TAP.
2. PRESS ADJUSTER BUTTON THEN "LH" IS SHOWN IN LED OF REMOTE CONTROLLER
3. PRESS MAX BUTTON WITH THE ADJUSTER BUTTON PRESSED. CURRENT FIGURE 01 TO 39 IS SHOWN IN LED OF REMOTE CONTROLLER
4. YOU CAN CHANGE TEST POINT GAS PRESSURE BY PRESSING THE MAX BUTTON WITH THE ADJUSTER BUTTTON PRESSED.

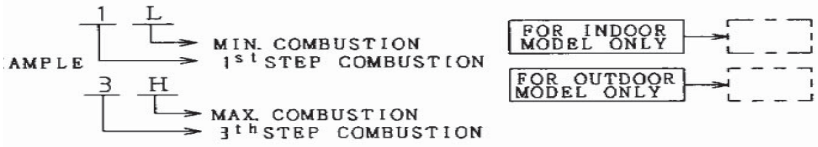
(EX.) EVERY TIME YOU PRESS THE MIN BUTTON, DISPLAY NUMBER CHANGES AS FOLLOWS.

01 → 02 → 03 → ····· → 37 → 38 → 39 → 02 ← 03 ····· ← 37 ← 38 ← 39

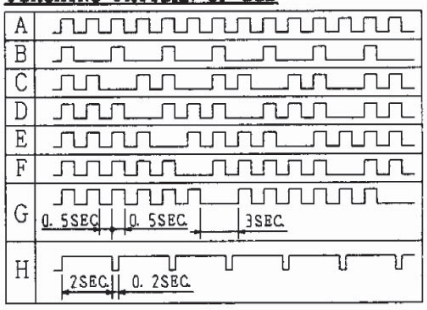
5. DETACH FROM THE MAX BUTTON AND THEN FROM THE ADJUSTER BUTTON IN THIS ORDER.

HOW TO CHECK TEST POINT PRESSURE

WHEN PRESSING MIN (MAX) BUTTON, COMBUSTION IS FIXED AT MIN (MAX) THEN LED OF REMOTE CONTROLLER SHOWS AS BELOW.



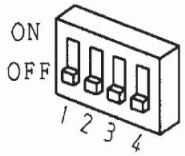
FLASHING PATTERN OF LED



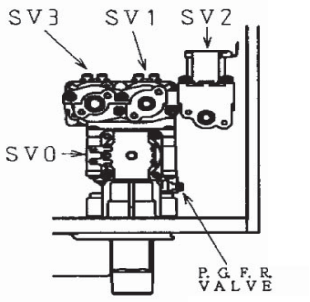
SEQUENCE NO.	OPERATIONAL FLOW CHART NO.
−0 ~ −9	1
A0 ~ A9 P0 ~ P9	2
C0 ~ C9	3
E0 ~ E9	4
H0 ~ H9 J0 ~ J9 L0 ~ L9	5

*LED DISPLAYS "ERROR CODE" AND "SEQUENCE NO." ALTERNATELY.

DIP SWITCH NORMAL MODE



SOLENOID VALVE LAYOUT



HOW TO CLEAR THE MEMORY OF "FAULT HISTORY"

- STOP OPERATION OF THE WATER HEATER & TURN OFF ALL THE DIP SWITCHES, THEN TURN THE FIRST DIP SWITCH ON THEN OFF.
- WITHIN 5 SEC. AFTER TURNING OFF THE DIP SWITCH PRESS EITHER MAX. OR MIN. BUTTON FOR MORE THAN 2 SEC.
- WHEN CLEARING LED FLASHING PATTERN

⚠ WARNING

- DO NOT ATTEMPT TO MAKE SHORT CIRCUIT OR TO MODIFY THE SAFETY DEVICES.
- DO NOT TAKE AWAY THE SAFETY DEVICES.
- USE ONLY PALOMA GENUINE PARTS

HOW TO SHOW MAINTENANCE INFORMATION

·FOR REMOTE CONTROLLER

ORDER	POWER SWITCH OF REMOTE CONTROLLER	OPERATIONAL PROCEDURE
①	OFF	PRESS BOTH TEMP. ADJUSTING KEYS ▲▼ AT THE SAME TIME FOR 3 SEC.
②	OFF	CHOOSE DESIRED INFORMATION BY PRESSING ▲ OR ▼.
③	ON	MAINTENANCE INFORMATION IS NOW INDICATED.
④	OFF	TO END MAINTENANCE INFORMATION
⑤	ON	(NORMAL OPERATION)

LEFT DIGIT (0∗→1∗···) IS CHANGED BY TEMP. ADJUSTING KEY ▼.
RIGHT ALPHABET (∗E→∗F···) IS CHANGED BY TEMP. ADJUSTING KEY ▲.

·AT CIRCUIT BOARD

DIP SWITCH	1	2	3	4	STATE OF DISPLAY
STATE OF SWITCH	OFF	OFF	—	—	NORMAL MODE
	ON	OFF	—	—	LATEST ERROR CODE
	OFF	ON	—	—	LATEST 2ND ERROR CODE
	ON	ON	—	—	LATEST 3RD ERROR CODE

FLAME ROD STATUS

「0y」INFORMATION	00	01	02	03	04	05	06	07
FLAME ROD1	×	○	×	○	×	○	×	○
FLAME ROD2	×	×	○	○	×	×	○	○
FLAME ROD3	×	×	×	×	○	○	○	○

×:FLAME ROD IS NOT DETECTING FLAME.
○:FLAME ROD IS DETECTING FLAME.

MAINTENANCE INFORMATION SHOWN IN LED DISPLAY OF REMOTE CONTROL

TEMPERATURE ADJUSTING KEY (▲)	RIGHT ALPHABET	TEMPERATURE ADJUSTING KEY (▼) LEFT DIGIT									
		0∗	1∗	2∗	3∗	4∗	5∗	6∗	7∗	8∗	9∗
	∗E	NULL	THE ERROR CODE OF RECENT 8 FAULTS								NULL
	∗F	NULL	THE SEQUENCE NO. OF RECENT 8 FAULTS								NULL
	∗C	TOTAL COMBUS-TION STARTS ** ×10000 TIMES	TOTAL COMBUSTION TIMES UNTIL RECENT N (1 TO 8) TIME OF ERROR. **×10000 TIMES								NULL
	∗d	TOTAL COMBUS-TION STARTS ** ×100 TIMES	TOTAL COMBUSTION TIMES UNTIL RECENT N (1 TO 8) TIME OF ERROR. **×100 TIMES								NULL
	∗H	TOTAL COMBUS-TION PERIOD ** ×1000 HRS.	TOTAL COMBUSTION PERIOD UNTIL RECENT N (1 TO 8) TIME OF ERROR. **×1000 HRS.								NULL
	∗J	TOTAL COMBUS-TION PERIOD **×10 HRS.	TOTAL COMBUSTION PERIOD UNTIL RECENT N (1 TO 8) TIME OF ERROR. **×10 HRS.								NULL
	∗y	FLAME ROD STATUS SEE ABOVE	WATER FLOW SENSOR **×0.1 Gallon /Minute	AMBIENT AIR THER-MISTOR **°F	WATER INLET THER-MISTOR **°F	HEAT EXCHAN-GER THER-MISTOR **°F	HOT WATER OUTLET THER-MISTOR **°F	FAN SPEED ** ×100 rpm	POWER FOR P.G.F.R VALVE **	NULL	NULL
	∗A	THERMO ELECTRO MOTIVE FORCE **mV	CONTROL LINE	FAN DETEC-TIVE VALUE	FAN MOTOR CURRENT	NULL	NULL	NULL	NULL	NULL	SEQUEN-CE NO.

Error Codes

Code	Fault	Remedy
05	Imperfect Combustion Alarm	Clean air inlet filter. Clean combustion air fan. Clean heat exchanger fins. Check for adequate combustion air ventilation openings and clean if necessary. Check vent system for partial blockage and correct as necessary.
10	Decrease of Fan Motor Ventilation Amount Air Supply or Exhaust Blockage (Warning)	Check all vent components for proper connections. Check that nothing is blocking the flue inlet or exhaust. Ensure condensation trap/drain was installed correctly. Ensure heat exchanger fins, fan, and air intake are not blocked.
11	Ignition Failure No Ignition	Ensure you have gas to the appliance and valves are turned ON. Ensure gas type and pressure is correct. Bleed all air from gas lines. Ensure gas line, meter, and regulator are sized properly. Ensure appliance is properly grounded. Check gas solenoid valves for open or short circuits. Ensure igniter is operational. Check igniter wiring harness for damage. Ensure maximum vertical vent length does not exceed allowable limits. Ensure total maximum vent length does not exceed allowable limits.
12	Flame Failure	Ensure you have gas to the appliance. Ensure gas type and pressure is correct. Bleed all air from gas lines. Ensure flame rod wire is connected. Check flame rod for carbon build-up. Ensure gas line, meter, and regulator are sized properly. Ensure appliance is properly grounded. Check gas solenoid valves for open or short circuits. Check power supply for proper voltage and voltage drops. Disconnect remote control; if it runs. Disconnect and re-connect all wiring harnesses on unit and PC board. Ensure proper venting material was installed. Ensure maximum vertical vent length does not exceed allowable limits. Ensure total maximum vent length does not exceed allowable limits.
13	Oxygen Depletion Sensor (O.D.S.) Working (Poor or Improper Combustion)	Ensure there is plenty of fresh air to the unit. Unit needs 1 square inch (6.5 cm2) for each 1,000 BTU of input. Check for a foreign materials in combustion chamber and/or O.D.S. Device.
14	Over Heating	Ensure high fire and low fire manifold pressure is correct. Check gas type of unit and ensure it matches gas type being used. Check heat exchanger for cracks and/or separations. Check for restrictions in airflow around unit and vent terminal. Check for a foreign materials in combustion chamber and/or exhaust piping. Check for clogged heat exchanger (scale buildup).

Code	Fault	Remedy
15	Boiling Safety Device	Check for closed water heater inlet valve or restriction in cold water inlet pipe (must be fully open). Check for clogged heat exchanger (scale buildup). On commercial water heater, lower set point temperature below 180F at high altitude.
16	Outlet Water Temperature Too High Over Temperature Warning	Check for clogged heat exchanger (scale buildup). Check for restrictions in airflow around unit and vent terminal. Check for a foreign materials in combustion chamber and/or exhaust piping.
21	Malfunction of Air Intake Filter Switch	Make sure air filter door is properly seated. Make sure front panel is properly installed.
24	Malfunction of Operational Switch	Disconnect remote control and retry. Verify unit is electrically grounded. Press max button on PCB to reset; Press min button on PCB to reset.
29	Heat Exchanger Outlet Temp. Too Low	Clean air inlet screen. Clean heat exchanger fins.
31	Water Inlet Thermistor Fault	Check thermistor wiring for damage. Ohm out thermistor. Check and clean scale from thermistor.
32	Heat Exchanger Thermistor Fault	Check thermistor wiring for damage. Ohm out thermistor. Check and clean scale from thermistor.
33	Hot Water Outlet Thermistor Fault	Check thermistor wiring for damage. Ohm out thermistor. Check and clean scale from thermistor.
34	Ambient Air Thermistor Fault	Check thermistor wiring for damage; Ohm out thermistor. Check and clean ambient air thermistor. Ensure fan blade is tight on motor shaft and it is in good condition. Check for restrictions in airflow around unit and vent terminal.
35	Improper Thermistor Connection	Check that all thermistors are connected to proper connections on PCB.
38	Malfunction of O.D.S. Circuit	The sensor itself is not responding to a self check from the PCB. Check wiring harness. Check for proper voltage.
51	Gas Inlet Solenoid Valve Fault	Check gas inlet solenoid valve wiring harness for loose or damage terminals. Ohm out solenoid valve.
52	Proportional Gas Control Valve Fault	Check proportional gas control valve wiring harness for loose or damage terminals. Ohm out proportional gas control valve.
61	Fan Failure	Ensure fan motor will turn freely. (Motor will operate with a small amount of restriction.) Check wiring harness to motor for damaged and/or loose connections. Check venting length not to exceed max lengths and bends.

Code	Fault	Remedy
65	Malfunction of Water Volume Control Motor	Check water flow solenoid valve wiring harness for loose or damage terminals. Check for proper voltage to water flow solenoid.
71	Gas Inlet Solenoid Valve Control Fault	Check gas inlet solenoid valve wiring harness for loose or damage terminals. Ohm out solenoid valve.
72	Detected False Flame Flame Sensing Device Fault	Ensure flame rod is touching flame when unit fires. Check inside burner chamber for any foreign material blocking flame at flame rod. Check all wiring to flame rod for damage. Check flame rod for proper voltage. Remove flame rod and check, clean with steel wool. Replace flame rod.
76	Communication Fault with Remote Control	Check remote control wiring for loose or damaged connections. Bypass remote control cable by connecting remote control directly to remote control terminals on PCB. Replace cable if found to be faulty.
79	Fan Motor Current Fault	Ensure fan motor will turn freely. (Motor will operate with a small amount of restriction.) Check fan motor for proper voltage and for water (condensation) damage.
80	Gas Cut-Off Failure (Solenoid Valve 1~2 Failure)	Ohm out all solenoid valves. Check voltage of all flame rods.
81	Extinction Failure (Solenoid Valve 1~2 Failure)	Ohm out all solenoid valves. Check voltage of all flame rods.
82	PCB data failure. PCB is not programmed.	Program PCB for proper altitude and fuel type circuit board with proper programming chip.
90	Blocked Flue Fault	Clean any blockage in heat exchanger, combustion fan, air inlet, and exhaust flue.
99	Decrease of Fan Motor Ventilation Amount (Operation Stop)	Clean air intake. Clean vent blockage. Check any blockage in heat exchanger and fan.
No Code	Nothing happens when water is flowing through unit.	Make sure unit is connected to proper power supply and circuit breakers are on. Clean inlet water supply filter. Ensure you have at least the minimum flow rate required to fire unit. On new installations ensure hot and cold water lines are not crossed. Check for bleed over. (Close cold water supply valve to water heater. Open hot water taps at fixtures. If water flows steady from hot water taps, there is a bleed over in the system.)
00	1 Hour continuous combustion (Products before December 2005)	Close all hot water taps to reset unit.

Hints For Diagnosis

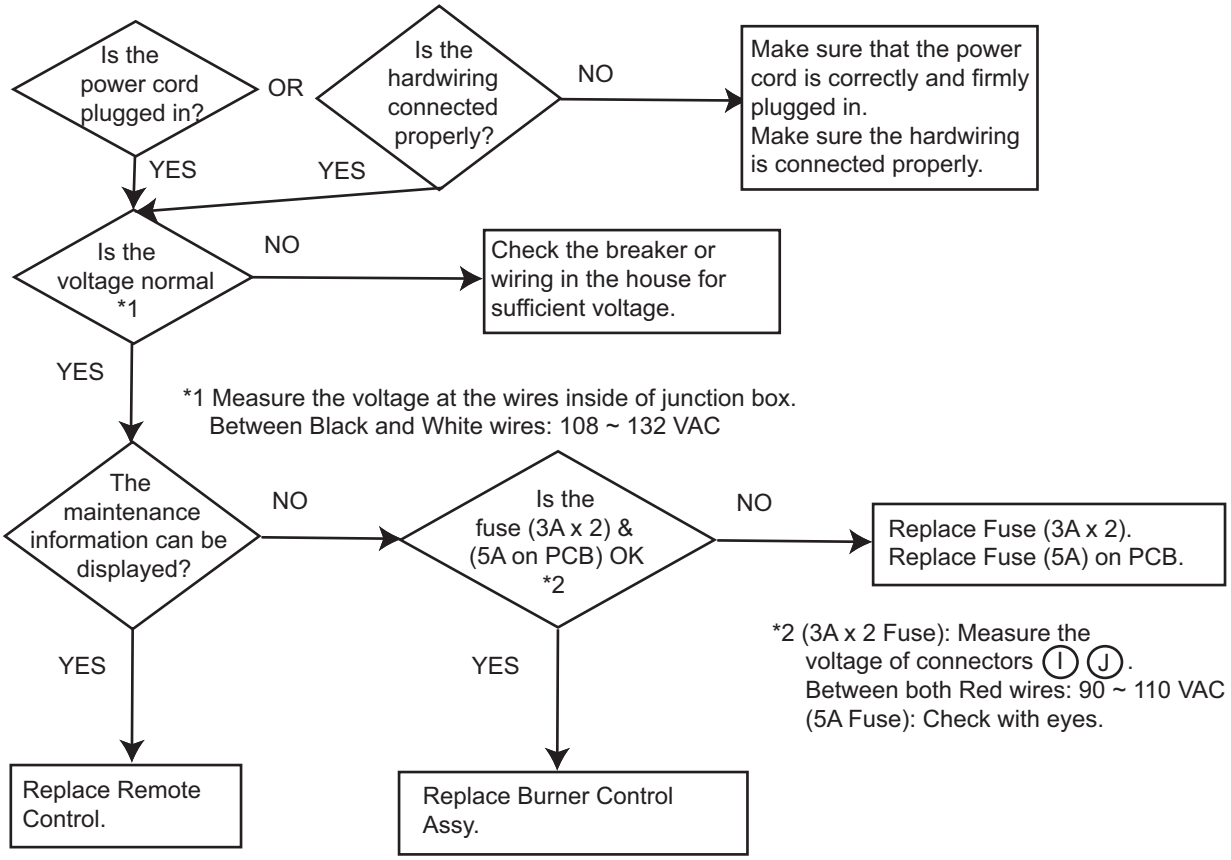
* Always inspect water heater by referring to the previous chapter "Operation System & Diagnostic Points" and/or the Operational Flow Chart.
* When measuring resistance of a part, turn off the electric power and make sure to disconnect the part completely before measuring (from connector or terminal).
* When measuring voltage, set the tester on the measurement point before electrified.
* When performing maintenance and/or servicing the water heater without front cover (opened), operate it by pushing the air filter switch (ON). Without pushing it (OFF), Error Code [21] is displayed. (Indoor Model Only)

CAUTION: When performing maintenance and/or servicing the water heater, turn off the electric power, gas shutoff valve and water shutoff valve. Wait for the water heater to become cool. Be careful to avoid injury to your fingers.

WARNING: Shock hazard line voltage is present. Before servicing the water heater, turn off the electric power to the water heater at the main disconnect or circuit breaker. Failure to do so could result in severe personal injury or death.

CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify correct operation after servicing.

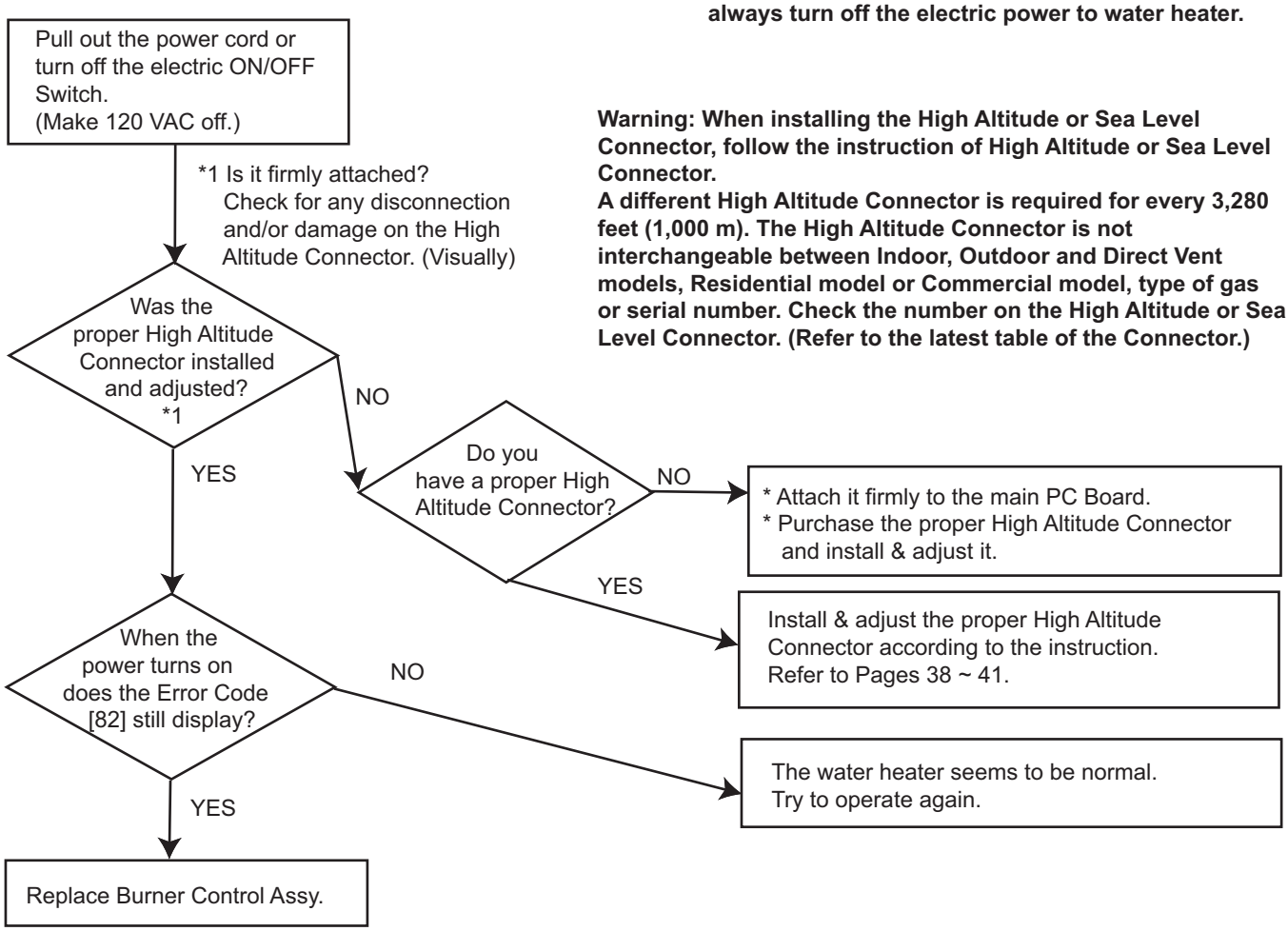
A. The ON/OFF Indicator (Green) on remote control does not light even if the Power Button is turned on.


Is the power cord plugged in?
OR
Is the hardwiring connected properly?
NO
Make sure that the power cord is correctly and firmly plugged in.
Make sure the hardwiring is connected properly.
YES
YES
Is the voltage normal *1
NO
Check the breaker or wiring in the house for sufficient voltage.
YES
*1 Measure the voltage at the wires inside of junction box.
Between Black and White wires: 108 ~ 132 VAC
The maintenance information can be displayed?
NO
Is the fuse (3A x 2) & (5A on PCB) OK *2
NO
Replace Fuse (3A x 2).
Replace Fuse (5A) on PCB.
*2 (3A x 2 Fuse): Measure the voltage of connectors (I) (J).
Between both Red wires: 90 ~ 110 VAC
(5A Fuse): Check with eyes.
YES
YES
Replace Remote Control.
Replace Burner Control Assy.

B. Error code is displayed when the Power Button on remote control turns on.

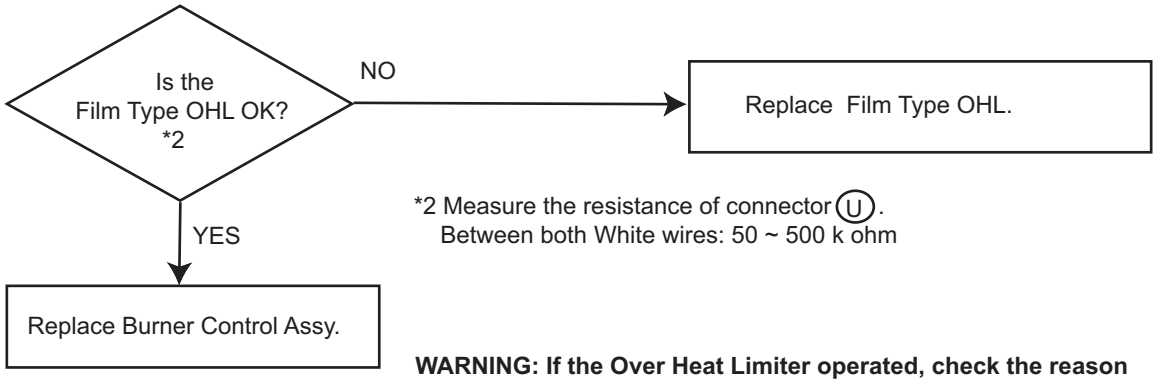
1. Error Code [82] (Gas Type Control Data Failure) is displayed.

WARNING: When replacing High Altitude Connector, always turn off the electric power to water heater.


Pull out the power cord or turn off the electric ON/OFF Switch. (Make 120 VAC off.)
*1 Is it firmly attached? Check for any disconnection and/or damage on the High Altitude Connector. (Visually)
Was the proper High Altitude Connector installed and adjusted? *1
NO
YES
Do you have a proper High Altitude Connector?
NO
* Attach it firmly to the main PC Board.
* Purchase the proper High Altitude Connector and install & adjust it.
YES
Install & adjust the proper High Altitude Connector according to the instruction. Refer to Pages 38 ~ 41.
When the power turns on does the Error Code [82] still display?
NO
The water heater seems to be normal. Try to operate again.
YES
Replace Burner Control Assy.

Warning: When installing the High Altitude or Sea Level Connector, follow the instruction of High Altitude or Sea Level Connector.
A different High Altitude Connector is required for every 3,280 feet (1,000 m). The High Altitude Connector is not interchangeable between Indoor, Outdoor and Direct Vent models, Residential model or Commercial model, type of gas or serial number. Check the number on the High Altitude or Sea Level Connector. (Refer to the latest table of the Connector.)

2. Error Code [14] (Over Heating) is displayed.

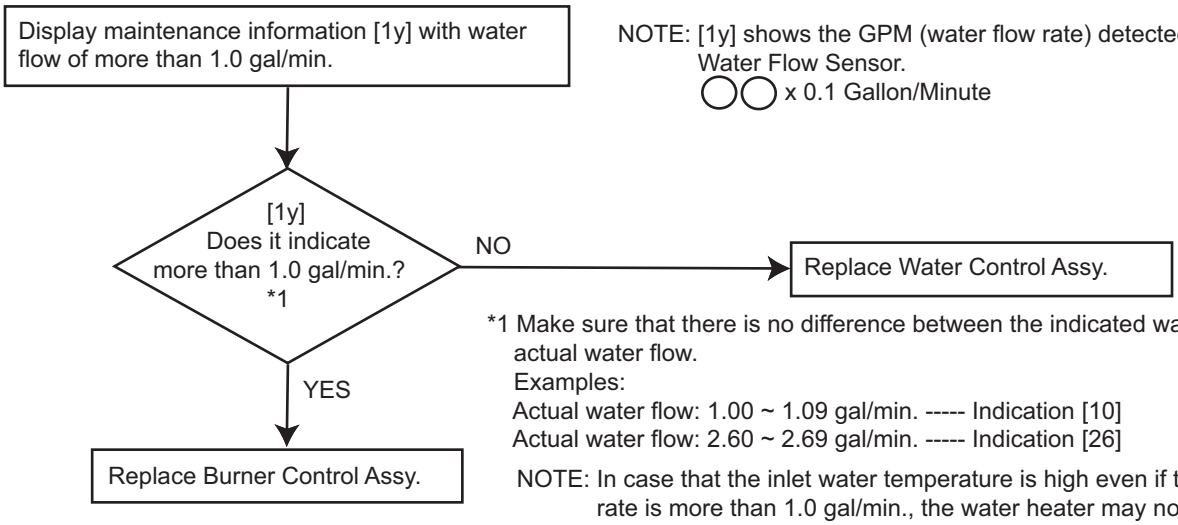


*2 Measure the resistance of connector (U).
Between both White wires: 50 ~ 500 k ohm

WARNING: If the Over Heat Limiter operated, check the reason why and correct the problem.

C. The Fan Motor does not activate even when the Hot Water Tap is opened.

1. No Error Code.

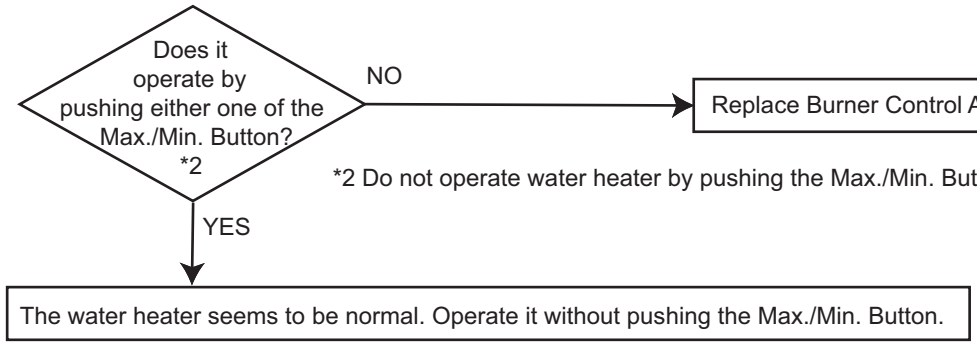


NOTE: [1y] shows the GPM (water flow rate) detected by Water Flow Sensor.
◯◯ x 0.1 Gallon/Minute

*1 Make sure that there is no difference between the indicated water flow and actual water flow.
Examples:
Actual water flow: 1.00 ~ 1.09 gal/min. ----- Indication [10]
Actual water flow: 2.60 ~ 2.69 gal/min. ----- Indication [26]

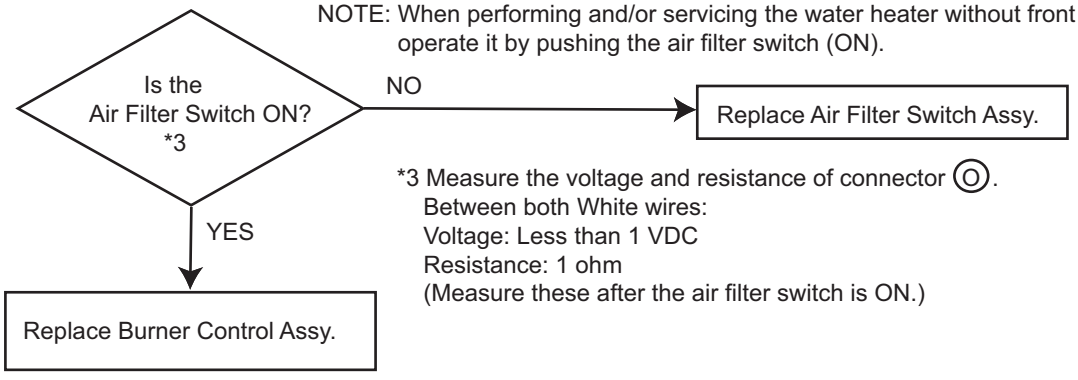
NOTE: In case that the inlet water temperature is high even if the water flow rate is more than 1.0 gal/min., the water heater may not ignite. In such case, set the temperature at the maximum.

2. Error Code [24] (Malfunction of Operation Switch) is displayed.


Does it operate by pushing either one of the Max./Min. Button?
*2
NO
Replace Burner Control Assy.
YES
The water heater seems to be normal. Operate it without pushing the Max./Min. Button.

*2 Do not operate water heater by pushing the Max./Min. Button on PC Board.

3. Error Code [21] (Malfunction of Air Intake Filter Switch) is displayed. (Indoor Model Only)

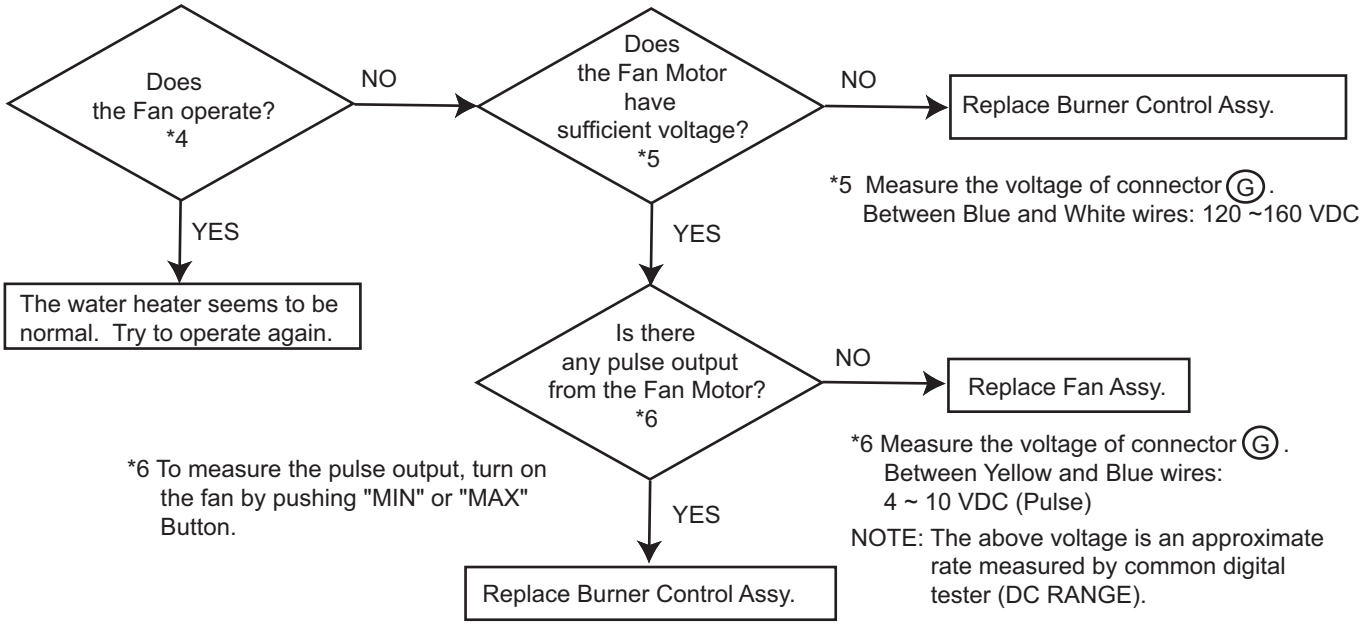


NOTE: When performing and/or servicing the water heater without front cover (opened), operate it by pushing the air filter switch (ON).

*3 Measure the voltage and resistance of connector ⓞ.
Between both White wires:
Voltage: Less than 1 VDC
Resistance: 1 ohm
(Measure these after the air filter switch is ON.)

4. Error Code [61] (Fan Failure) is displayed.

*4 Check that the fan turns round with eyes (visually).
Check that there are some air volume from outlet terminal or flue outlet.



*5 Measure the voltage of connector (G).
Between Blue and White wires: 120 ~160 VDC

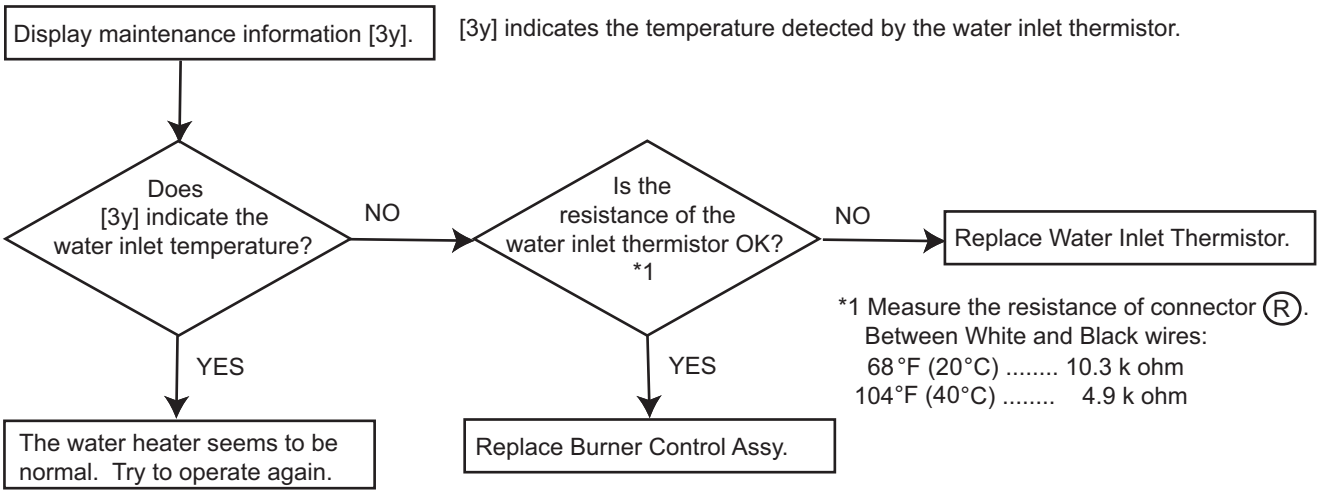
*6 To measure the pulse output, turn on the fan by pushing "MIN" or "MAX" Button.

*6 Measure the voltage of connector (G).
Between Yellow and Blue wires:
4 ~ 10 VDC (Pulse)

NOTE: The above voltage is an approximate rate measured by common digital tester (DC RANGE).

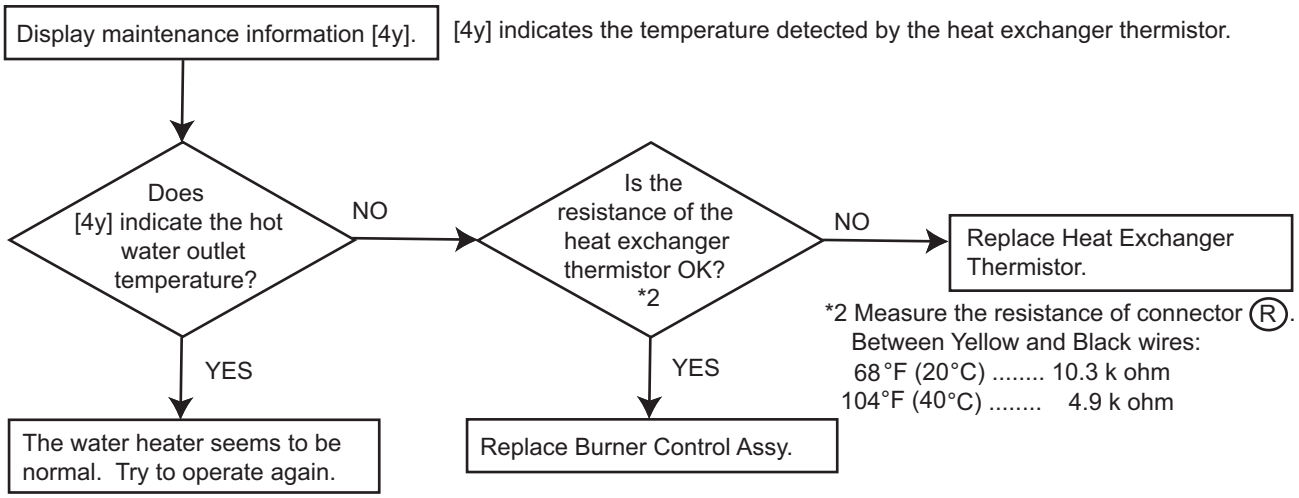
D. Does not try to ignite even if the Fan is activated.

1. Error Code [31] (Water Inlet Thermistor Disconnection) is displayed.

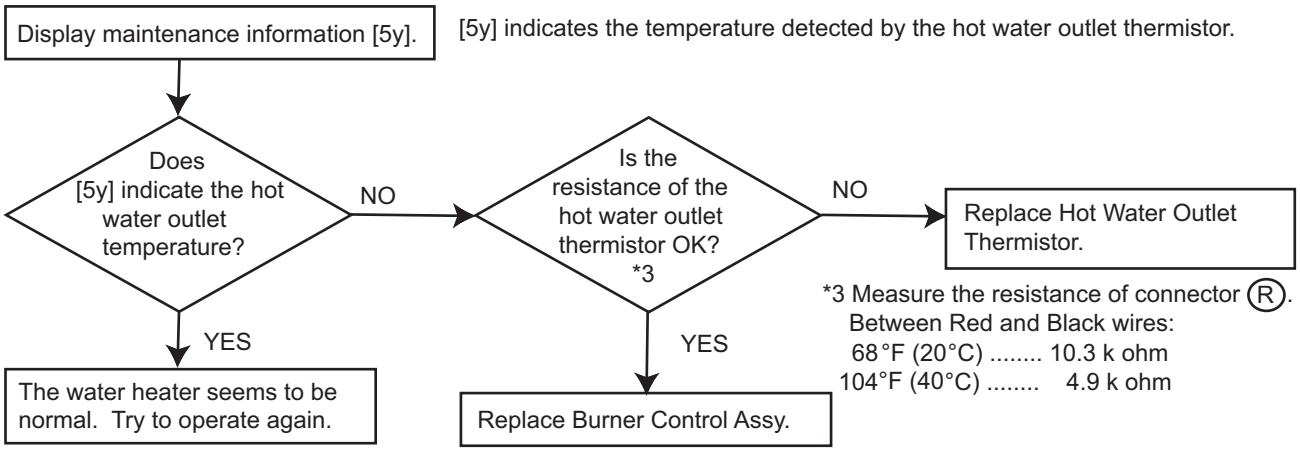

Display maintenance information [3y].
[3y] indicates the temperature detected by the water inlet thermistor.
Does [3y] indicate the water inlet temperature?
NO
Is the resistance of the water inlet thermistor OK? *1
NO
Replace Water Inlet Thermistor.
YES
YES
The water heater seems to be normal. Try to operate again.
Replace Burner Control Assy.

*1 Measure the resistance of connector (R).
Between White and Black wires:
68 °F (20°C) ..... 10.3 k ohm
104°F (40°C) ..... 4.9 k ohm

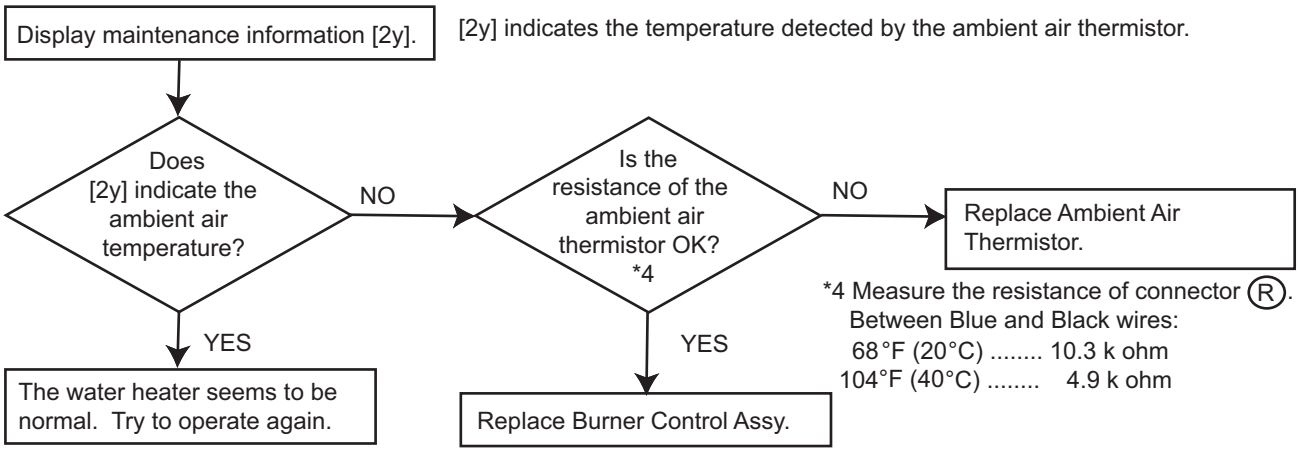
2. Error Code [32] (Heat Exchanger Thermistor Disconnection) is displayed.


Display maintenance information [4y].
[4y] indicates the temperature detected by the heat exchanger thermistor.
Does [4y] indicate the hot water outlet temperature?
NO
Is the resistance of the heat exchanger thermistor OK? *2
NO
Replace Heat Exchanger Thermistor.
YES
YES
The water heater seems to be normal. Try to operate again.
Replace Burner Control Assy.
*2 Measure the resistance of connector (R).
Between Yellow and Black wires:
68°F (20°C) ..... 10.3 k ohm
104°F (40°C) ..... 4.9 k ohm

3. Error Code [33] (Hot Water Outlet Thermistor Disconnection) is displayed.


Display maintenance information [5y].
[5y] indicates the temperature detected by the hot water outlet thermistor.
Does [5y] indicate the hot water outlet temperature?
NO
Is the resistance of the hot water outlet thermistor OK? *3
NO
Replace Hot Water Outlet Thermistor.
YES
YES
The water heater seems to be normal. Try to operate again.
Replace Burner Control Assy.
*3 Measure the resistance of connector (R).
Between Red and Black wires:
68°F (20°C) ..... 10.3 k ohm
104°F (40°C) ..... 4.9 k ohm

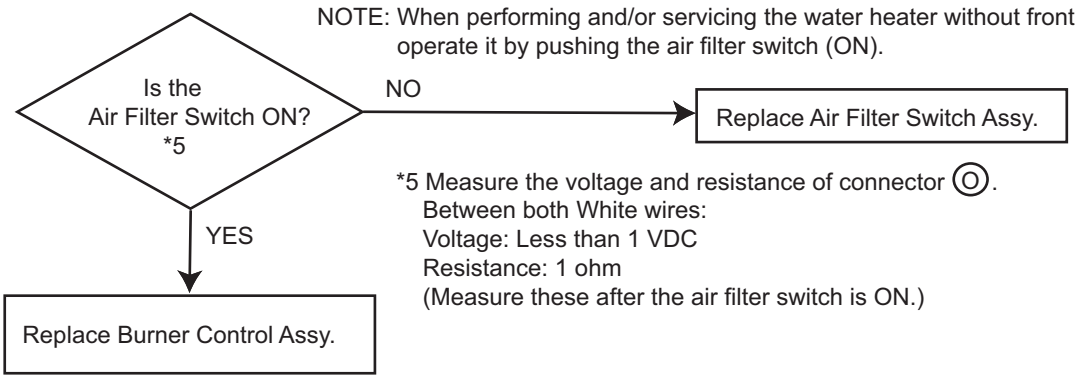
4. Error Code [34] (Ambient Air Thermistor Disconnection, Short Circuit) is displayed.


Display maintenance information [2y].
[2y] indicates the temperature detected by the ambient air thermistor.
Does [2y] indicate the ambient air temperature?
NO
Is the resistance of the ambient air thermistor OK? *4
NO
Replace Ambient Air Thermistor.
YES
YES
The water heater seems to be normal. Try to operate again.
Replace Burner Control Assy.
*4 Measure the resistance of connector (R).
Between Blue and Black wires:
68°F (20°C) ..... 10.3 k ohm
104°F (40°C) ..... 4.9 k ohm

5. Error Code [61] (Fan Failure) is displayed.

Refer to the previous C-4 (Error Code [61]).

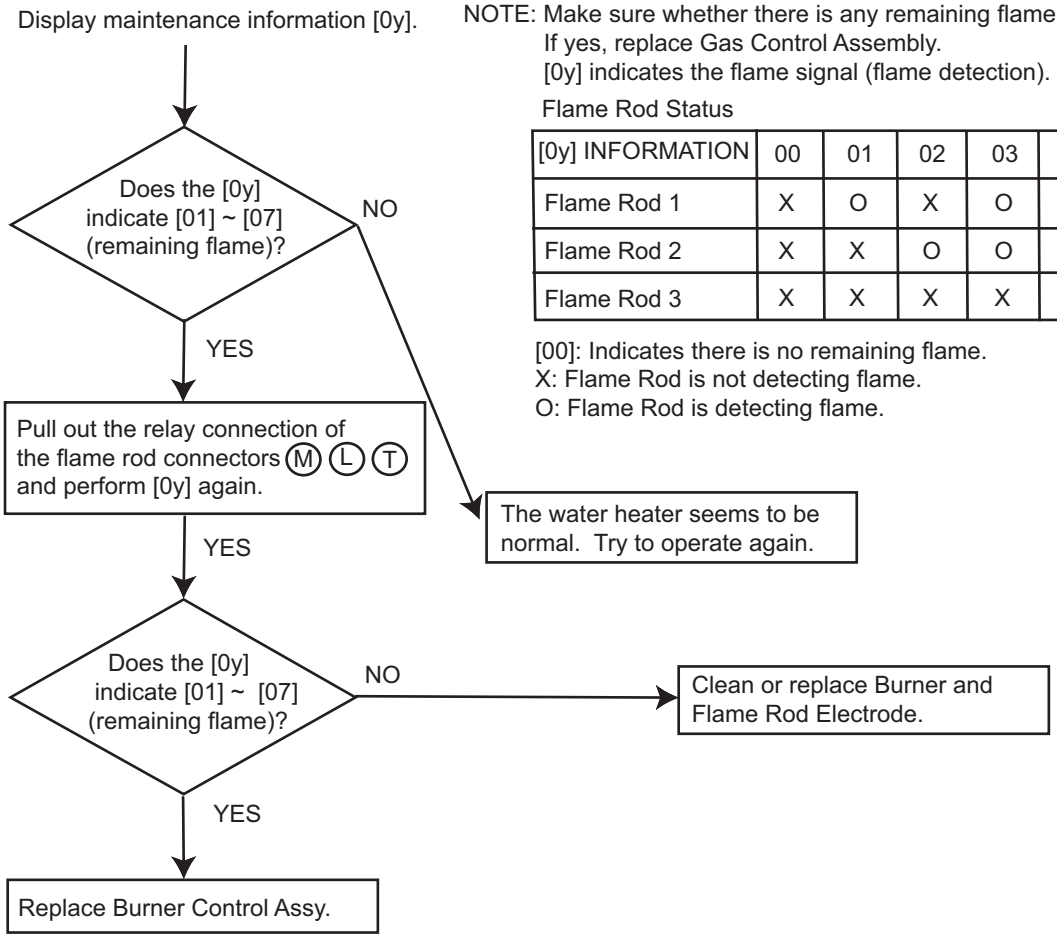
6. Error Code [21] (Malfunction of Air Intake Filter Switch) is displayed. (Indoor Model Only)



NOTE: When performing and/or servicing the water heater without front cover (opened), operate it by pushing the air filter switch (ON).

*5 Measure the voltage and resistance of connector ⓞ.
Between both White wires:
Voltage: Less than 1 VDC
Resistance: 1 ohm
(Measure these after the air filter switch is ON.)

7. Error Code [72] (Detected False Flame) is displayed.


Display maintenance information [0y].
Does the [0y] indicate [01] ~ [07] (remaining flame)?
NO
YES
Pull out the relay connection of the flame rod connectors (M) (L) (T) and perform [0y] again.
YES
The water heater seems to be normal. Try to operate again.
Does the [0y] indicate [01] ~ [07] (remaining flame)?
NO
Clean or replace Burner and Flame Rod Electrode.
YES
Replace Burner Control Assy.

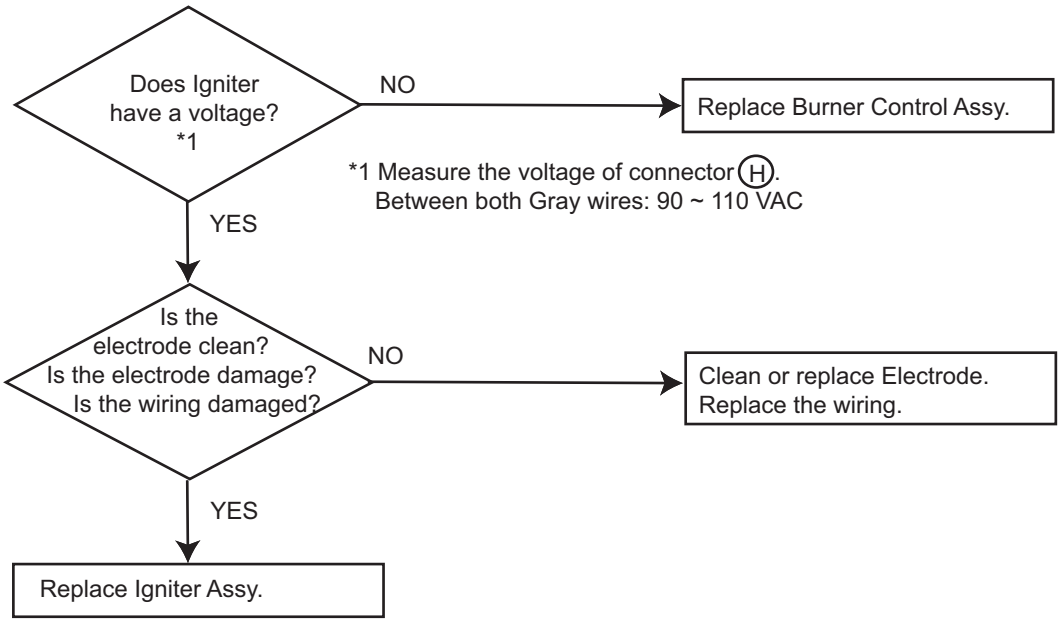
NOTE: Make sure whether there is any remaining flame or not. (Visually)
If yes, replace Gas Control Assembly.
[0y] indicates the flame signal (flame detection).

Flame Rod Status

[0y] INFORMATION	00	01	02	03	04	05	06	07
Flame Rod 1	X	O	X	O	X	O	X	O
Flame Rod 2	X	X	O	O	X	X	O	O
Flame Rod 3	X	X	X	X	O	O	O	O

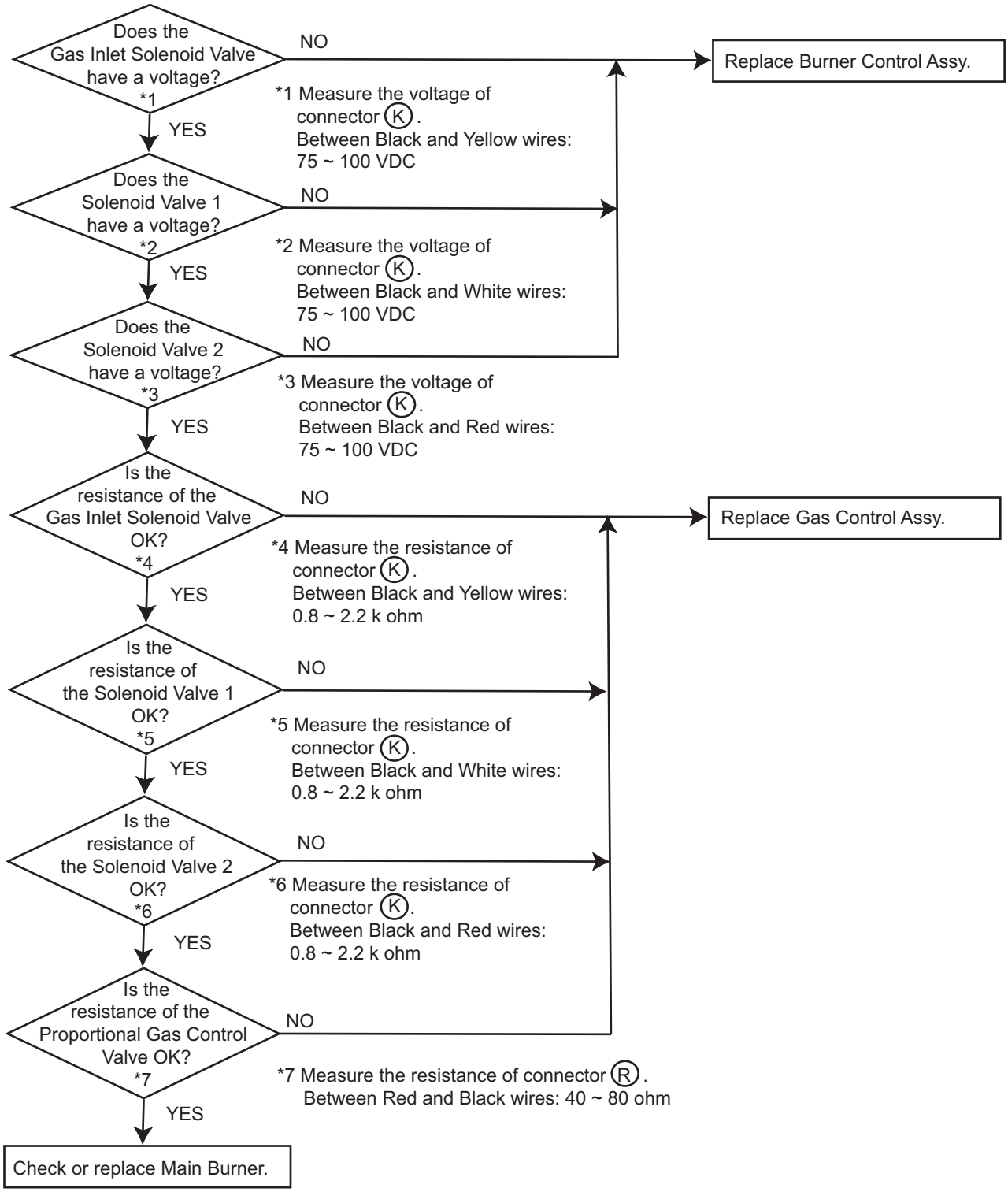
[00]: Indicates there is no remaining flame.
X: Flame Rod is not detecting flame.
O: Flame Rod is detecting flame.

E. The igniter does not spark and indicates Error Code [11] even when the Fan is operating. (Ignition Failure)

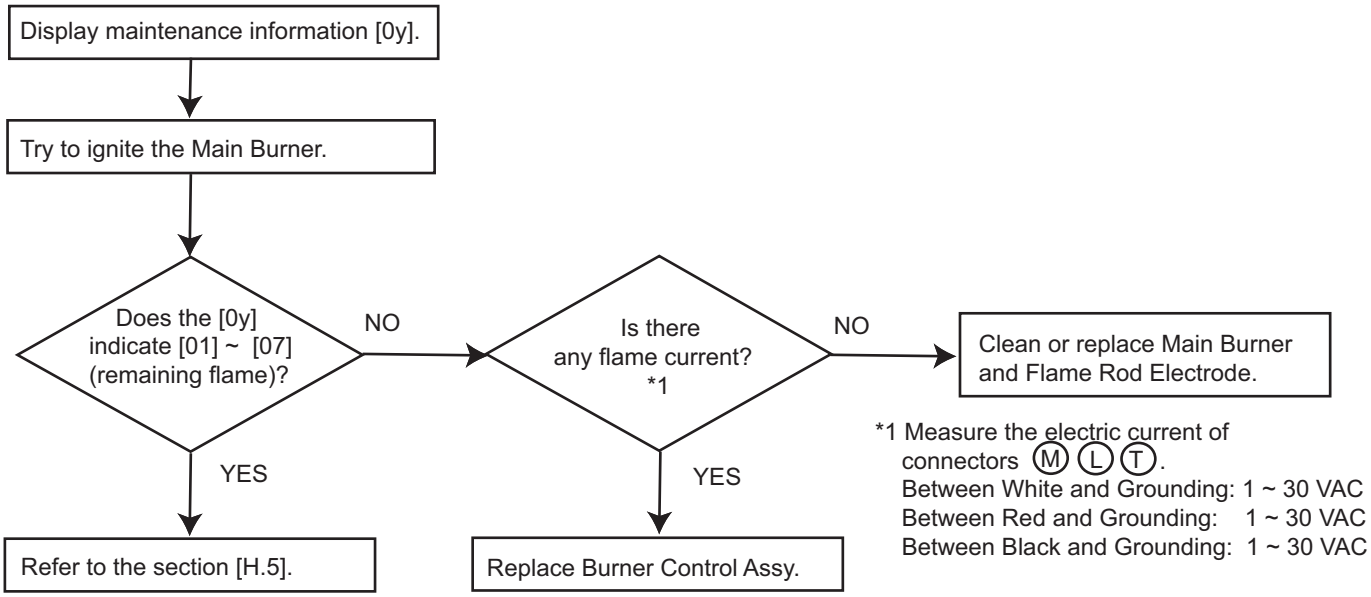

Does Igniter have a voltage? *1
NO
Replace Burner Control Assy.
YES
Is the electrode clean? Is the electrode damage? Is the wiring damaged?
NO
Clean or replace Electrode. Replace the wiring.
YES
Replace Igniter Assy.

*1 Measure the voltage of connector (H).
Between both Gray wires: 90 ~ 110 VAC

F. Does not ignite the Main Burner and indicates Error Code [11] even when the Igniter sparks. (Ignition Failure)

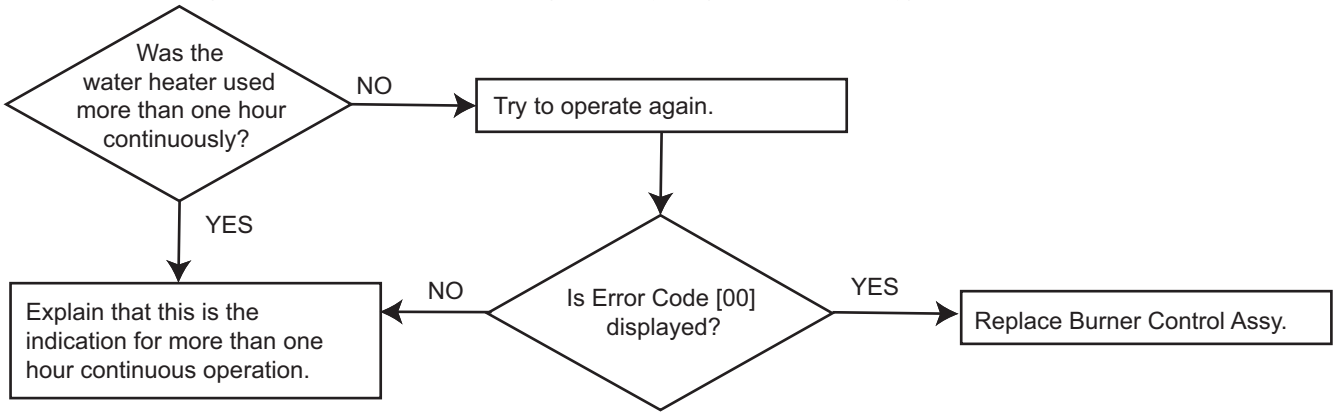

Does the Gas Inlet Solenoid Valve have a voltage? *1
NO
Replace Burner Control Assy.
YES
*1 Measure the voltage of connector (K). Between Black and Yellow wires: 75 ~ 100 VDC
Does the Solenoid Valve 1 have a voltage? *2
NO
YES
*2 Measure the voltage of connector (K). Between Black and White wires: 75 ~ 100 VDC
Does the Solenoid Valve 2 have a voltage? *3
NO
YES
*3 Measure the voltage of connector (K). Between Black and Red wires: 75 ~ 100 VDC
Is the resistance of the Gas Inlet Solenoid Valve OK? *4
NO
Replace Gas Control Assy.
YES
*4 Measure the resistance of connector (K). Between Black and Yellow wires: 0.8 ~ 2.2 k ohm
Is the resistance of the Solenoid Valve 1 OK? *5
NO
YES
*5 Measure the resistance of connector (K). Between Black and White wires: 0.8 ~ 2.2 k ohm
Is the resistance of the Solenoid Valve 2 OK? *6
NO
YES
*6 Measure the resistance of connector (K). Between Black and Red wires: 0.8 ~ 2.2 k ohm
Is the resistance of the Proportional Gas Control Valve OK? *7
NO
YES
*7 Measure the resistance of connector (R). Between Red and Black wires: 40 ~ 80 ohm
Check or replace Main Burner.

G. Main Burner shuts off after ignition. (In Use Indicator on remote control does not turn on) Error Code [11] is displayed. (Ignition Failure)

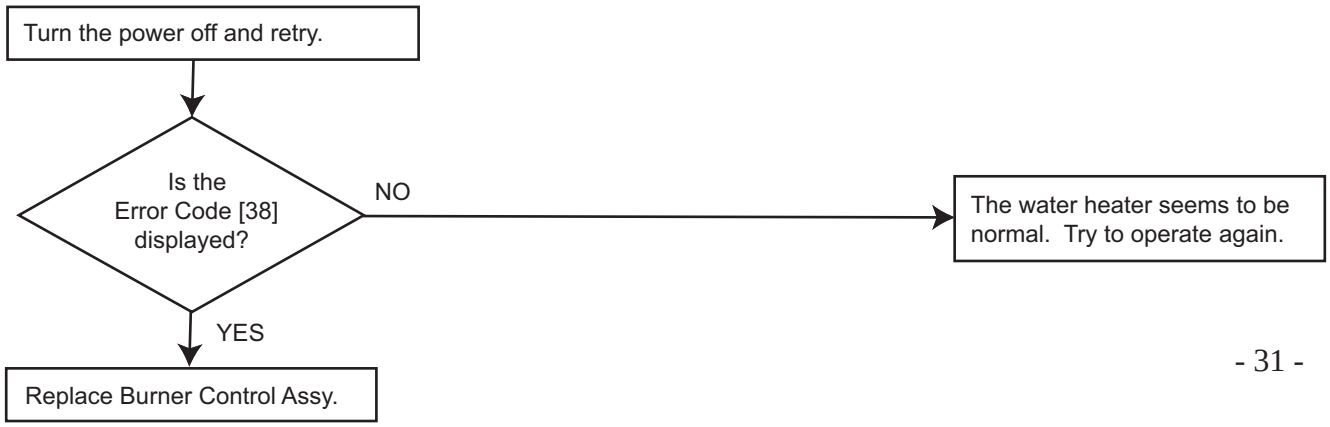

Display maintenance information [0y].
Try to ignite the Main Burner.
Does the [0y] indicate [01] ~ [07] (remaining flame)?
NO
YES
Refer to the section [H.5].
Is there any flame current? *1
NO
YES
Replace Burner Control Assy.
Clean or replace Main Burner and Flame Rod Electrode.
*1 Measure the electric current of connectors Ⓜ Ⓛ Ⓣ.
Between White and Grounding: 1 ~ 30 VAC
Between Red and Grounding: 1 ~ 30 VAC
Between Black and Grounding: 1 ~ 30 VAC

H. Main Burner is ignited, but goes off during the operation. (In Use Indicator on remote control is ON [Red].)

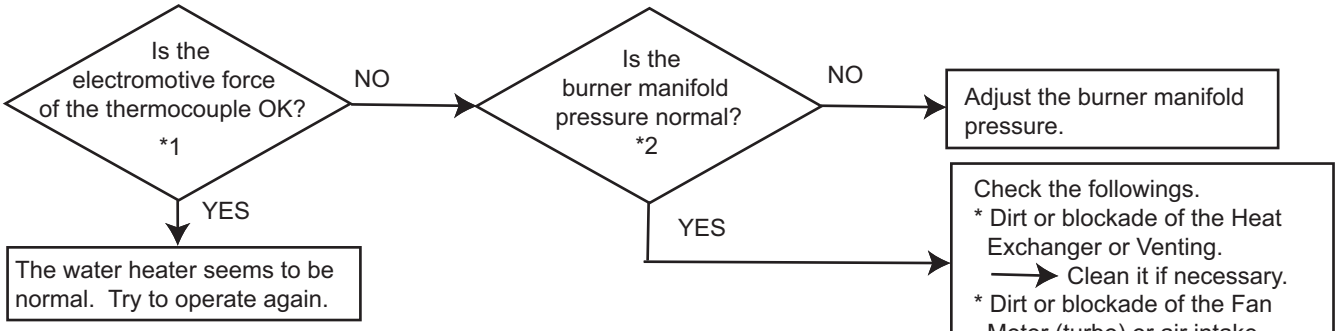
1. Error Code [00] (1 Hour Continuous Combustion) is displayed. (Indoor Model Only)


Was the water heater used more than one hour continuously?
NO
Try to operate again.
YES
Explain that this is the indication for more than one hour continuous operation.
NO
Is Error Code [00] displayed?
YES
Replace Burner Control Assy.

2. Error Code [38] (Malfunction of Oxygen Depletion Safety Circuit) is displayed.


Turn the power off and retry.
Is the Error Code [38] displayed?
NO
The water heater seems to be normal. Try to operate again.
YES
Replace Burner Control Assy.

3. Error Code [13] (Oxygen Depletion Safety Device Working) is displayed. (Indoor & Direct Vent Model Only)


Is the electromotive force of the thermocouple OK? *1
NO
Is the burner manifold pressure normal? *2
NO
Adjust the burner manifold pressure.
YES
The water heater seems to be normal. Try to operate again.
YES
Check the followings.
* Dirt or blockade of the Heat Exchanger or Venting. → Clean it if necessary.
* Dirt or blockade of the Fan Motor (turbo) or air intake on the front cover. → Clean it if necessary.
* Blockade of the flame opening of the sensing burner. → Clean the entire burner assy. including sensing burner.
* Disconnection of the thermocouple and connector. → Replace the upper burner assy. Attach the connector firmly.

*1 Measure the voltage of connector (Q).
Between Red and White wires: 8 ~ 30m VDC

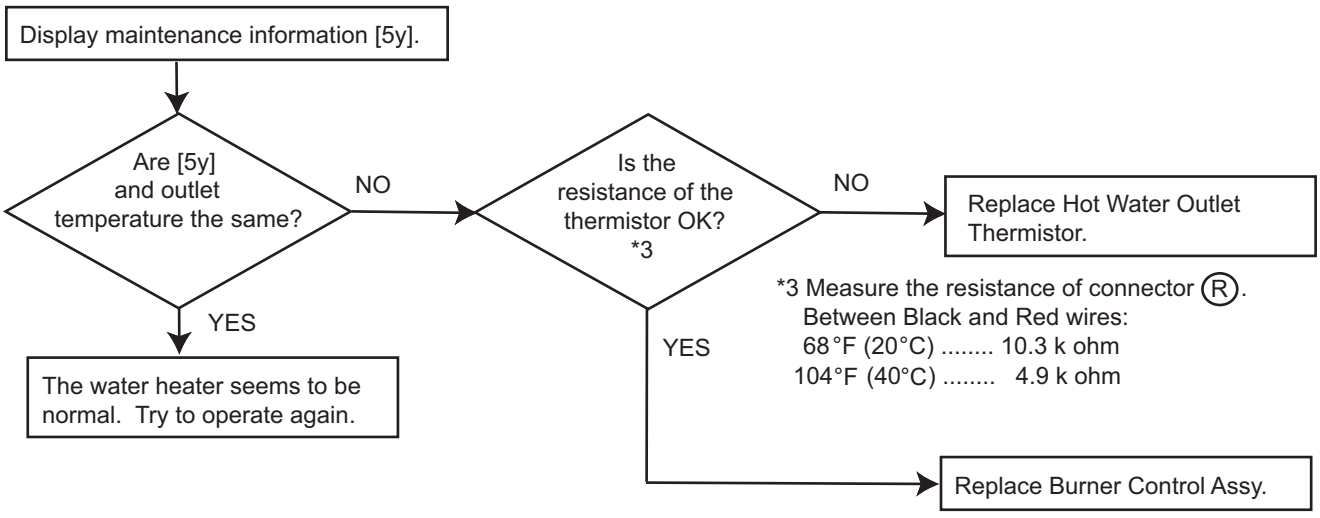
*2 Measure the burner manifold pressure. (Refer to Pages 35 ~ 37 for adjustment of manifold pressure.)

PH-28 Indoor	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.52 + fan pressure (max.)	0.45 + fan pressure (min.)
L.P. Gas	7.36 + fan pressure (max.)	1.22 + fan pressure (min.)

PH-28 Outdoor	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.32 + fan pressure (max.)	0.43 + fan pressure (min.)
L.P. Gas	6.61 + fan pressure (max.)	1.10 + fan pressure (min.)

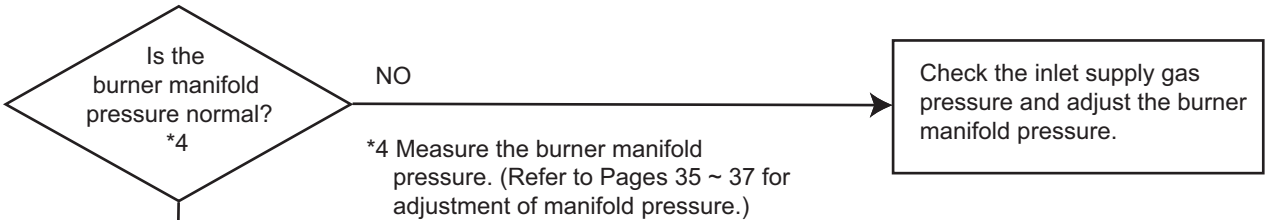
PH-28 DV	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.36 + fan pressure (max.)	0.42 + fan pressure (min.)
L.P. Gas	7.28 + fan pressure (max.)	1.15 + fan pressure (min.)

4. Error Code [15] (Boiling Safety Device, Empty Boiling Safety Device) is displayed.


Display maintenance information [5y].
Are [5y] and outlet temperature the same?
NO
Is the resistance of the thermistor OK? *3
NO
Replace Hot Water Outlet Thermistor.
YES
The water heater seems to be normal. Try to operate again.
YES
Replace Burner Control Assy.

*3 Measure the resistance of connector (R).
Between Black and Red wires:
68 °F (20 °C) ..... 10.3 k ohm
104 °F (40 °C) ..... 4.9 k ohm

5. Error Code [12] (Flame Failure) is displayed.


Is the burner manifold pressure normal? *4
NO
Check the inlet supply gas pressure and adjust the burner manifold pressure.
YES
Check or replace Main Burner, Flame Rod Electrode, etc. inside combustion chamber.

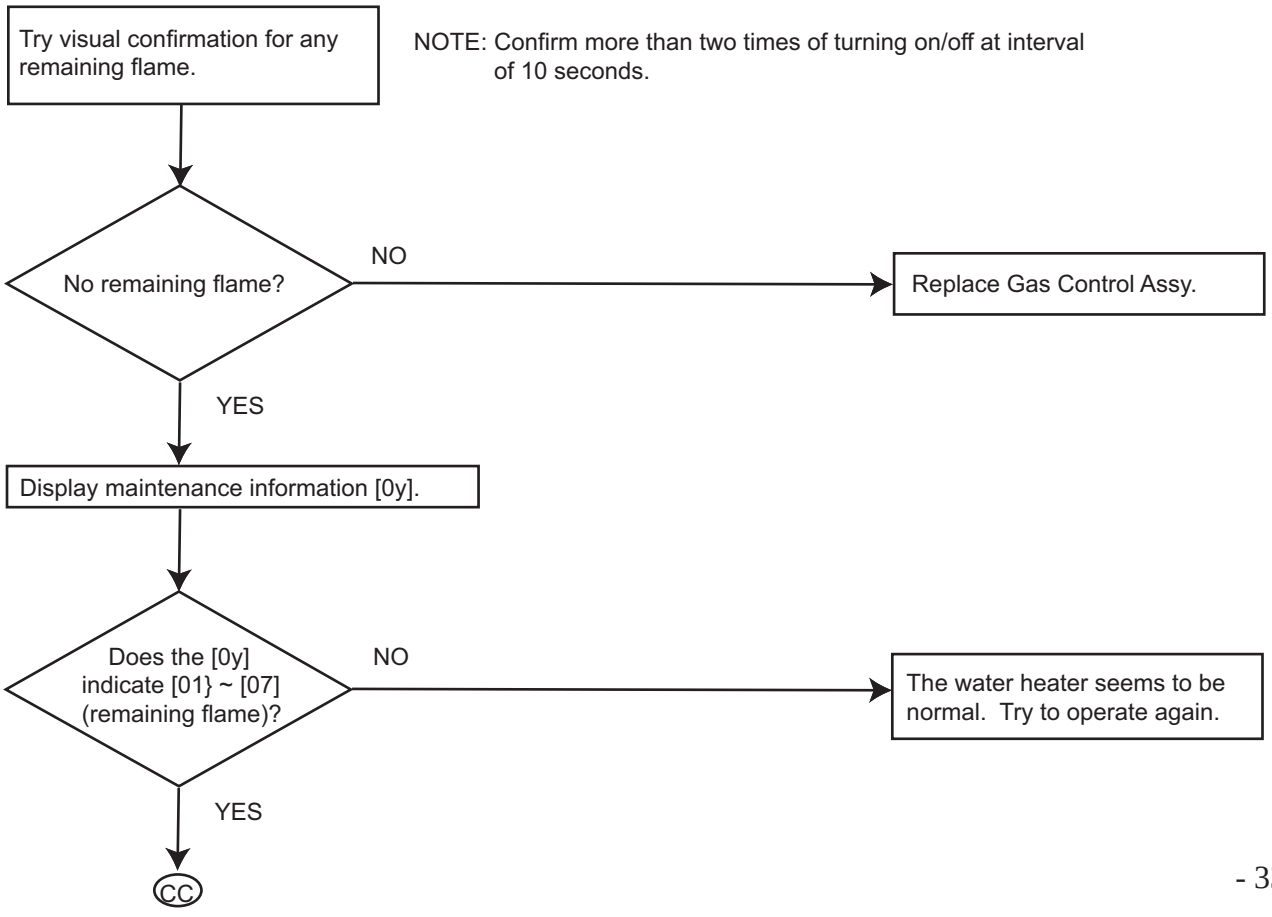
*4 Measure the burner manifold pressure. (Refer to Pages 35 ~ 37 for adjustment of manifold pressure.)

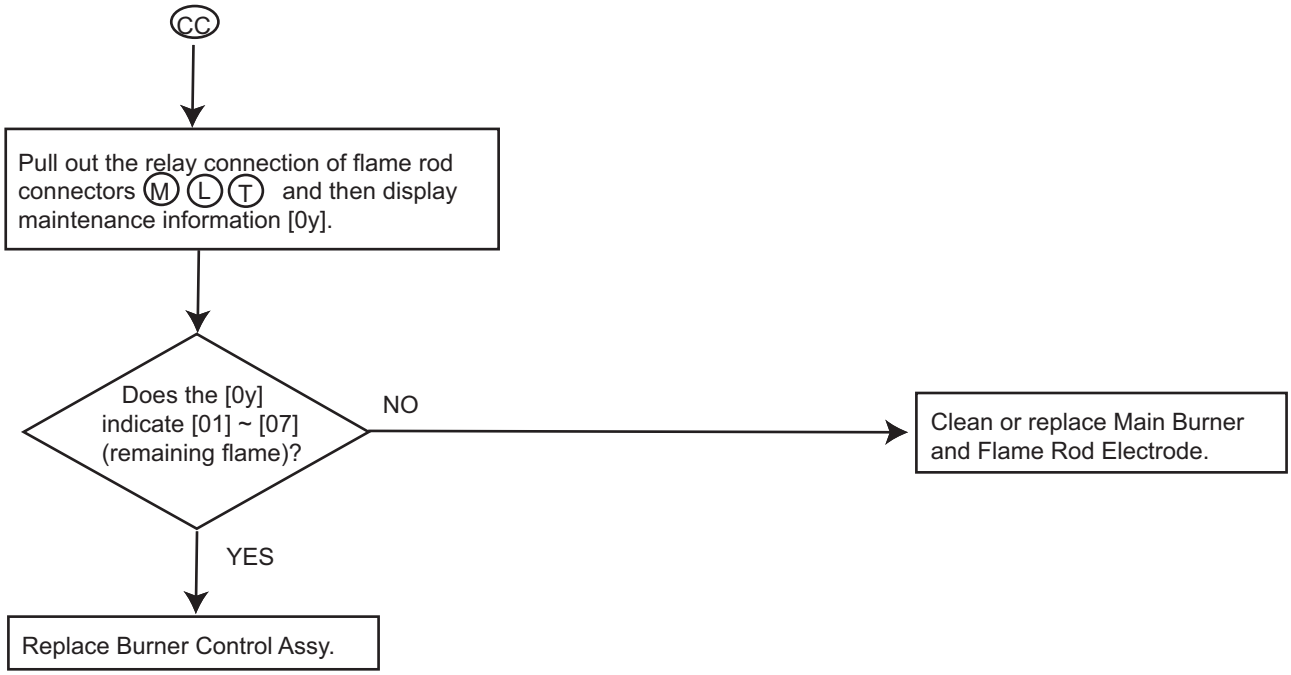
PH-28 Indoor	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.52 + fan pressure (max.)	0.45 + fan pressure (min.)
L.P. Gas	7.36 + fan pressure (max.)	1.22 + fan pressure (min.)

PH-28 Outdoor	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.32 + fan pressure (max.)	0.43 + fan pressure (min.)
L.P. Gas	6.61 + fan pressure (max.)	1.10 + fan pressure (min.)

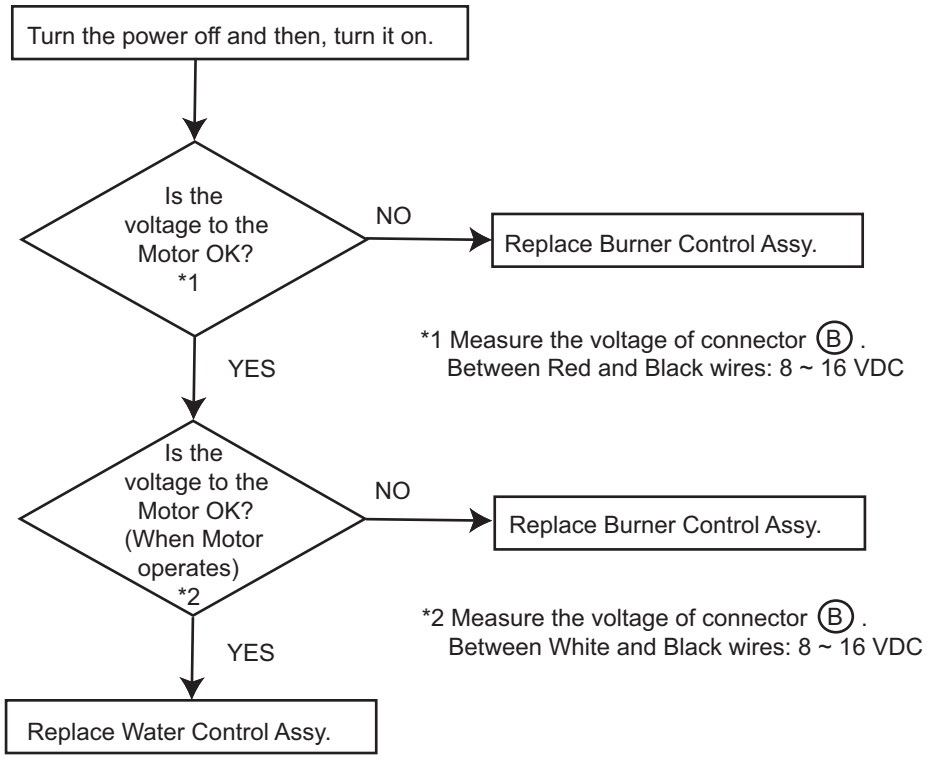
PH-28 DV	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.36 + fan pressure (max.)	0.42 + fan pressure (min.)
L.P. Gas	7.28 + fan pressure (max.)	1.15 + fan pressure (min.)

I. After shutting off hot water, Error Code [51] (Gas Inlet Solenoid Valve Failure), [80] (Gas Cut-Off Function Failure, Solenoid Valve 1~3 Failure) or [81] (Extinction Failure, Solenoid Valve 1~3 Failure) is displayed.


Try visual confirmation for any remaining flame.
NOTE: Confirm more than two times of turning on/off at interval of 10 seconds.
No remaining flame?
NO
Replace Gas Control Assy.
YES
Display maintenance information [0y].
Does the [0y] indicate [01} ~ [07] (remaining flame)?
NO
The water heater seems to be normal. Try to operate again.
YES
CC


CC
Pull out the relay connection of flame rod connectors M L T and then display maintenance information [0y].
Does the [0y] indicate [01] ~ [07] (remaining flame)?
NO
Clean or replace Main Burner and Flame Rod Electrode.
YES
Replace Burner Control Assy.

J. Error Code [65] (Malfunction of Water Volume Control Motor) is displayed.


Turn the power off and then, turn it on.
Is the voltage to the Motor OK? *1
NO
Replace Burner Control Assy.
*1 Measure the voltage of connector B.
Between Red and Black wires: 8 ~ 16 VDC
YES
Is the voltage to the Motor OK? (When Motor operates) *2
NO
Replace Burner Control Assy.
*2 Measure the voltage of connector B.
Between White and Black wires: 8 ~ 16 VDC
YES
Replace Water Control Assy.

ADJUSTMENT

Adjustment of Burner Control Assembly (PC Board):

The content on this page is intended for use by qualified service personnel only.

WARNING: Improper adjustment, alteration, service or maintenance can cause property damage, personal injury, or death.

When replaced the Burner Control Assembly, adjust as follows.

WARNING: Without the adjustment, the water heater may not function properly.

[I] <Record the Original Figures>

Before replacing with the new PC Board, record the original minimum and maximum settings from the old PC Board.

(a) Original Minimum Figure:
- (1) Push the Adjusting Button on the PC Board.
- (2) Continue pushing the Adjusting Button, push the “Min.” Button once on the PC Board.
- (3) The original minimum figure [01 ~ 39] is displayed on the LED of remote control.
- (4) Record the displayed figure.

(b) Original Maximum Figure:
- (1) Push the Adjusting Button on the PC Board.
- (2) Continue pushing the Adjusting Button, push the “Max.” Button once on the PC Board.
- (3) The original minimum figure [01 ~ 39] is displayed on the LED of remote control.
- (4) Record the displayed figure.

(C) Find out the adjusted figures at the factory on the front plate and record these figures.

[II] <Adjustment of Burner Manifold Pressure>

(a) Measurement of Fan Pressure:

Measure the fan pressure before adjusting the burner manifold pressure. The fan pressure differs depending on models, types of gas or installation condition. Measure the fan pressure at each installation site.

[Measurement of "Minimum" Capacity]
- (1) Without opening the hot water tap, push the "Min." Button on PC Board.
- (2) Using the manometer, measure and record the pressure (in. w.c.).

[Measurement of "Maximum" Capacity]
- (1) Without opening the hot water tap, push the "Max." Button on PC Board.
- (2) Using the manometer, measure and record the pressure (in. w.c.).

(b) Adjustment of Burner Manifold Pressure:

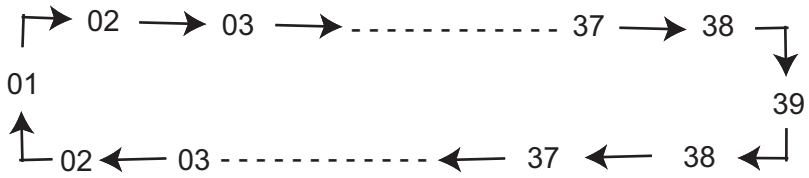
NOTE: Always start from "Minimum" when adjusts the burner manifold pressure.

NOTE: The display is on remote control. Always connect the remote control.

Continue to the next page.

[Adjustment of "Minimum" Capacity]
(1) Open the hot water tap gradually until the water heater ignites at the minimum operating water flow.
(2) Push the Adjusting Button on the PC Board. ([LH] is displayed on the LED of remote control.)
(3) Continue to pushing the Adjusting Button, push the “Min.” Button on the PC Board. (The current figure [01 ~ 39] is displayed on the LED of remote control.)
(4) At the condition that the Adjusting Button is continue to pushing , you can change the test gas pressure by pushing the “Min.” Button every time. Change the figure until the same original minimum figure is displayed on the LED of remote control.
(5) Make sure the manifold pressure by the manometer and compare with the adjusted figure at the factory on the front plate. If not the same, using the manometer, adjust the minimum manifold pressure to the standard pressure + (plus) the previous measured fan pressure of minimun capacity.

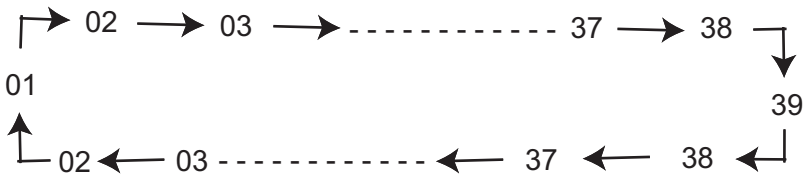
[Example]: Every time you push the “Min.” Button, the display number changes as follows.



(6) Detach from the “Min.” Button and then from the Adjusting Button in this order.

[Adjustment of "Maximum" Capacity]
(1) Open the hot water tap fully.
(2) Push the Adjusting Button on the PC Board. ([LH] is displayed on the LED of remote control.)
(3) Continue to pushing the Adjusting Button, push the “Max.” Button on the PC Board. (The current figure [01 ~ 39] is displayed on the LED of remote control.)
(4) At the condition that the Adjusting Button is continue to pushing, you can change the test gas pressure by pushing the “Max.” Button every time. Change the figure until the same original maximum figure is displayed on the LED of remote control.
(5) Make sure the manifold pressure by the manometer and compare with the adjusted figure at the factory on the front plate. If not the same, using the manometer, adjust the maximum manifold pressure to the standard pressure + (plus) the previous measured fan pressure of maximum capacity.

[Example]: Every time you push the “Max.” Button, the display number changes as follows.



(6) Detach from the “Max.” Button and then from the Adjusting Button in this order.

Continue to the next page.

Note: If the [EE] is displayed on the LED of remote control, adjust the above again with caution in the (6).

[How To Check Test Point Gas Pressure]
When push the “Max.” (or “Min.”) Button, the combustion is fixed at “Max.” (or ”Min.”) and then the LED of remote control displays as follows.

[Example]

1 L → Minimum Combustion → 1st Step Combustion

3 H → Maximum Combustion → 3rd Step Combustion

Check the table below for the PCB and model.

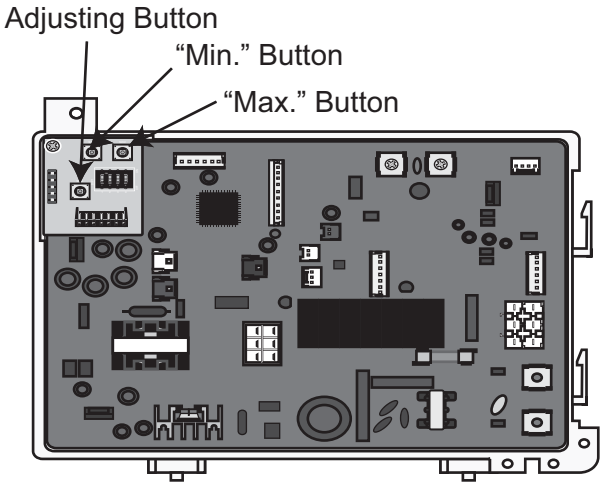
PCB Item No.	Model No.
31-51531	PH-28RIFS
31-51511	PH-28ROF
31-51535	PH-28CIFS
31-51515	PH-28COF
31-51310	PH-28RIFS-1,2 PH-28CIFS-1,2 PH-28RDVS-1,2 PH-28CDVS-1,2
31-51300	PH-28ROF-1,2 PH-28COF-1,2

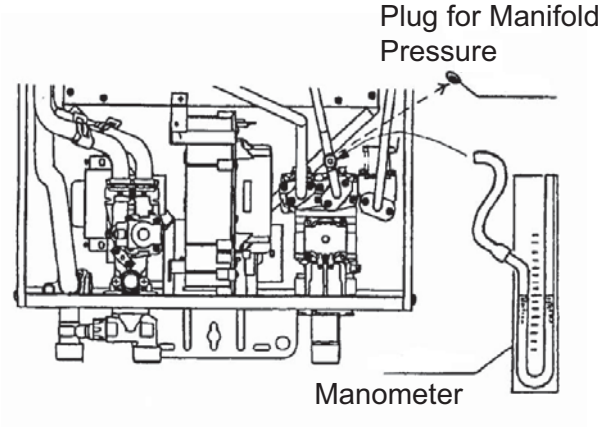
The adjusted manifold pressure must be as follows.

PH-28 Indoor	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.52 + fan pressure (max.)	0.45 + fan pressure (min.)
L.P. Gas	7.36 + fan pressure (max.)	1.22 + fan pressure (min.)

PH-28 Outdoor	MAX. (in. w.c.)	MIN. (in. w.c.)
NAT. Gas	2.32 + fan pressure (max.)	0.43 + fan pressure (min.)
L.P. Gas	6.61 + fan pressure (max.)	1.10 + fan pressure (min.)

PH-28 DV	MAX. (in. w.c.)
NAT. Gas	2.36 + fan pressure (max.)
L.P. Gas	7.28 + fan pressure (max.)
	MIN. (in. w.c.)
NAT. Gas	0.42 + fan pressure (min.)
L.P. Gas	1.15 + fan pressure (min.)





[III] <Adjustment of Altitude Connector Setting>

The original PC Board on the water heater from a factory is set at the sea level operation (0 ~ 3,280 feet)(0 ~ 1,000 m), however the altitude setting of the PC Board for after-sales service (spare parts) is NOT set at any level. When the Burner Control Assembly was replaced, the adjustment of Altitude Connector is also required.

(A) When the water heater is installed at the sea level (0 ~ 3,280 feet)(0 ~ 1,000 m), adjust the altitude connector setting according to the instruction of the Sea Level DIP Switch Adjustment.

(B) When the water heater is installed at the high altitude (above 3,280 feet)(1,000 m), adjust the high altitude connector setting according to the High Altitude DIP Switch Adjustment.

For High Altitude Installation Above 3,280 Feet (1,000 M):

WARNING: Improper adjustment, alteration, service or maintenance can cause property damage, personal injury, or death.

High Altitude DIP Switch Adjustment

When the water heater is installed above 3,280 feet (1,000 m) or when the Burner Control Assembly (PCB) was replaced, the adjustment of the High Altitude Chip is required for high altitude installation.

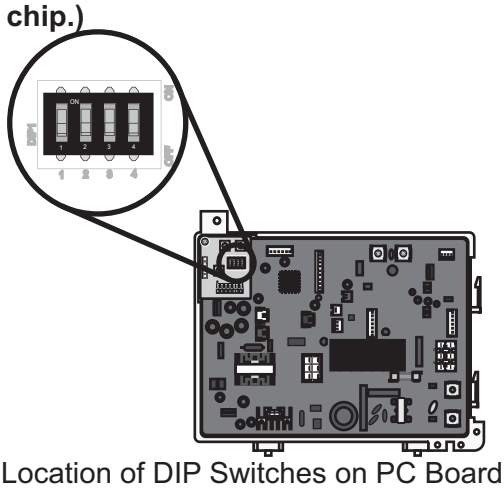
Without adjusting the PCB by the High Altitude Chip, the water heater may not function properly.

Notice: If the water heater is installed less than 3,280 feet (1,000 m), no High Altitude Chip is required or supplied and no action is required.

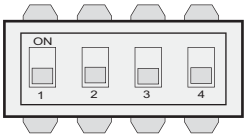
How to adjust the High Altitude Chip on the PCB for high altitude installation:

(1) Check the altitude (above sea level) where the water heater is installed.
(2) If the altitude is more than 3,280 feet (1,000 m), the adjustment of the High Altitude Chip is required.
(3) Ensure that you have the correct High Altitude Chip for proper model, gas type and altitude.
(4) Disconnect the electric power to the water heater. Turn off the gas shutoff valve and water shutoff valve.
(5) Remove the front cover.
(6) Place High Altitude Chip as shown on PCB (Refer to diagram on this section.)
(7) Turn on the electric power.
(8) Find the DIP Switch #1 and #2 located at the top left hand side of the PCB (Refer to illustration for DIP Switch location).
(9) Change the DIP Switch #1 and #2 setting to the “ON” position. DO NOT alter any other DIP Switch. (The LED on the PCB is flashing. At the same time, the display of the MAIN/BATH remote control starts to flash.)
(10) Find the Adjusting Button located at the top left hand side of the PCB.
(11) Press the Adjusting Button until the LED on the PCB (the display of the remote control) changes “Flashing” to “Illuminating”.

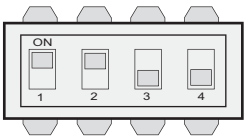
NOTICE: A different High Altitude Chip is required for every 3,280 feet (1,000 m). The High Altitude Chip is not interchangeable between Indoor, Outdoor and Direct Vent models, types of gas and serial number. Check the number on the High Altitude Chip. (Refer to the table comes with the chip.)



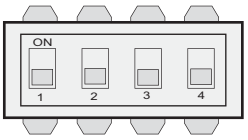
Location of DIP Switches on PC Board.



As set from factory

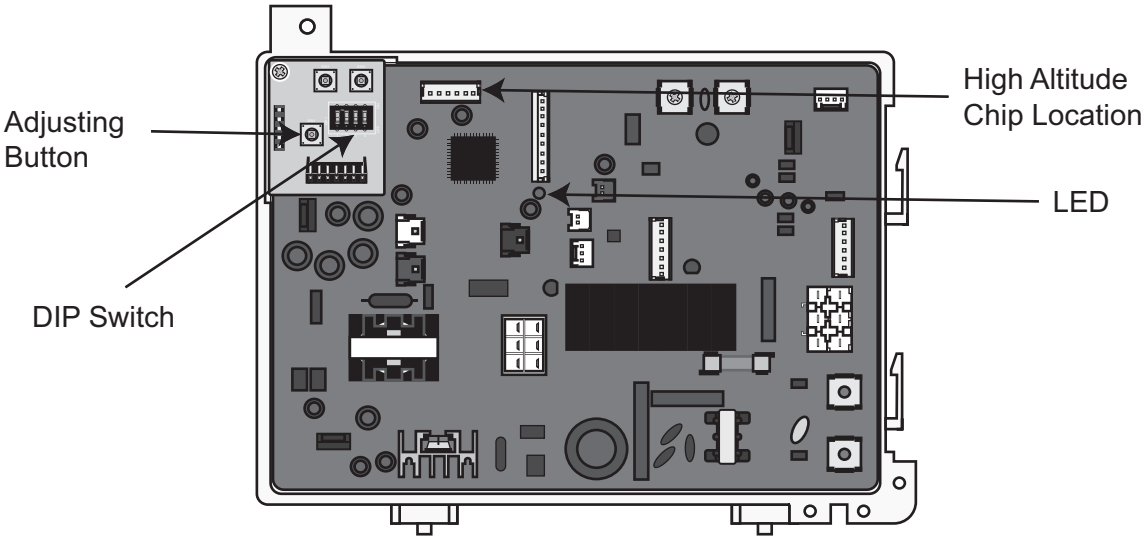


Setting during adjustment to DIP Switch #1 and #2 for High Altitude.



Setting after adjustment to DIP Switch #1 and #2 for High Altitude.

(12) Change the Dip Switch #1 and #2 setting to the “OFF” position. DO NOT alter any other DIP Switch. (The LED on the PCB and the display of the remote control stops illuminating.)
(13) Attach the unit’s front cover.
(14) Turn on the gas shutoff valve and water shutoff valve.
(15) Check and ensure safe operation and performance of the water heater.



High Altitude Chip for PC Board.

Rating of gas appliances are based on sea level operation and need not be changed for installations at elevations up to 3,280 feet (1,000 m).

Notice: For installation above 3,280 feet (1,000 m), the PC Board must be set for High Altitude installation.

Notice: A different High Altitude Chip is required for every 3,280 feet (1,000 m). The High Altitude Chip is not interchangeable between Indoor, Outdoor and Direct Vent models, types of gas and serial number. Check the number on the High Altitude Chip. (Refer to the table comes with the chip.)

WARNING: ANTI-SCALD WARNING FOR HIGH ALTITUDE USE: If you are installing a PH-28C Unit that you intend to set a high temperatures of 170-180ºF (77-82ºC), note that the danger of scalding from steam is greater at high altitudes, especially when pressure drops suddenly. Always use such hot water in a closed system where accidental production of steam cannot harm the operator. Never allow such hot water to come directly from a tap or other exposes outlet.

WARNING: ERROR CODE 15 AT HIGH ALTITUDE: If your system produces an Error Code 15 at high altitude, water is being boiled in the heat exchanger. The first step in troubleshooting is to lower the output temperature setting.

WARNING: When PH-28CDVSP (Direct Vent Model, L.P. Gas) is installed at the altitude of 6,561 to 9,840 feet (2,000 to 3,000 m) with the high altitude chip, the maximum vent length should be reduced 5 feet (1.5 m). Refer to the table of the water heater instruction manual.

For Sea Level Installation 0 ~ 3,280 Feet (0 ~ 1,000 M):

WARNING: Improper adjustment, alteration, service or maintenance can cause property damage, personal injury, or death.

Sea Level DIP Switch Adjustment

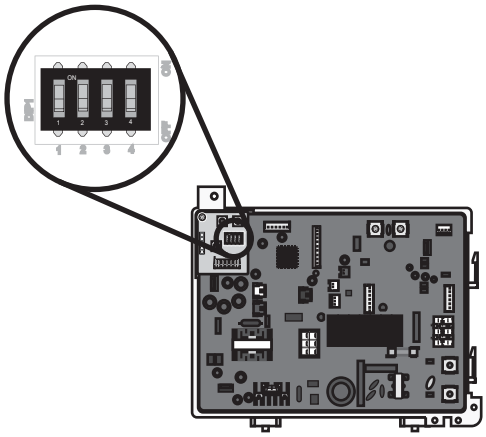
The original PC Board on the water heater from a factory is set at the sea level operation (0 ~ 3,280 feet) (0 ~ 1,000 m), however the altitude setting of the PC board for after-sales service (spare parts) is NOT set at any level.
When the Burner Control Assembly (PCB) was replaced, the adjustment of Sea Level Chip is also required. (When the water heater is required back to the sea level operation from high altitude setting, the same adjustment is required.)

Without adjusting the Sea Level Chip, the water heater may not function properly.

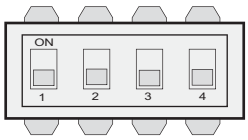
How to adjust the Sea Level Chip on the PCB:

(1) Make sure again that the water heater is installed at the sea level (0 ~ 3,280 feet) (0 ~ 1,000 m).
(2) If the altitude is more than 3,280 feet (1,000 m), the adjustment of the High Altitude Chip is required. (Refer to the proper section.)
(3) Ensure that you have the correct Sea Level Chip for proper model and gas type.
(4) Disconnect the electric power to the water heater. Turn off the gas shutoff valve and water shutoff valve.
(5) Remove the front cover.
(6) Place Sea Level Chip as shown on PCB (Refer to diagram on this section.)
(7) Turn on the electric power.
(8) Find the DIP Switch #1 and #2 located at the top left hand side of the PCB (Refer to illustration for DIP Switch location).
(9) Change the DIP Switch #1 and #2 setting to the “ON” position. DO NOT alter any other DIP Switch. (The LED on the PCB is flashing. At the same time, the display of the MAIN/BATH remote control starts to flash.)
(10) Find the Adjusting Button located at the top left hand side of the PCB.
(11) Press the Adjusting Button until the LED on the PCB (the display of the remote control) changes “Flashing” to “Illuminating”.

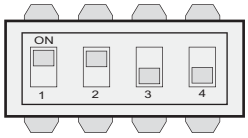
NOTICE: A different Sea Level Chip is required for Indoor, Outdoor and Direct Vent models, type of gas and serial number.
Check the number on the Sea Level Chip. (Refer to the table comes with the chip.)



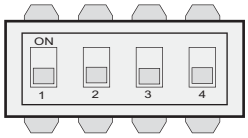
Location of DIP Switches on PC Board.



As set from factory

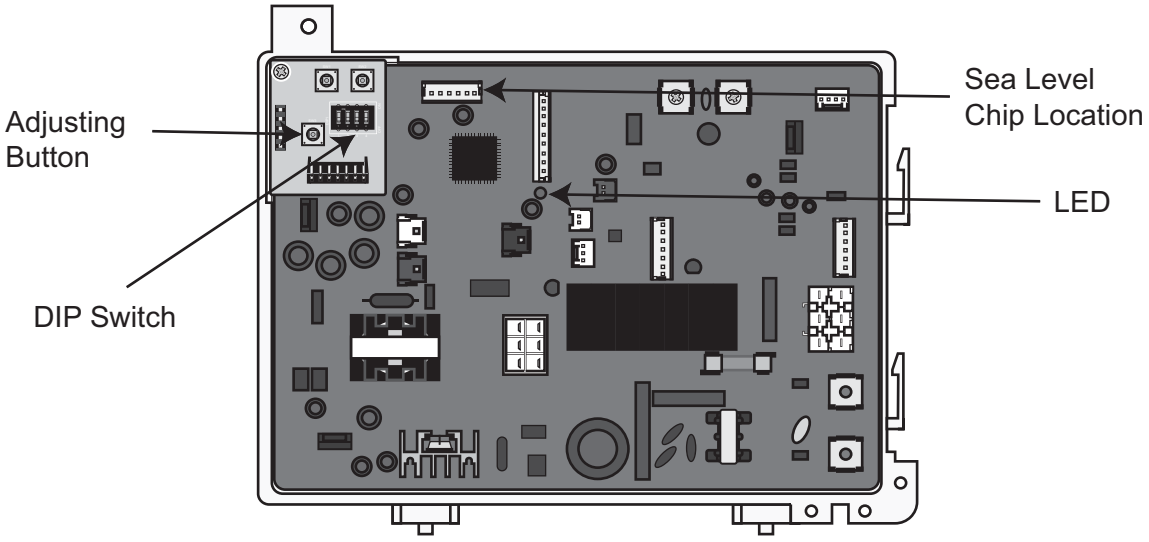


Setting during adjustment to DIP Switch #1 and #2 for Sea Level.



Setting after adjustment to DIP Switch #1 and #2 for Sea Level.

(12) Change the Dip Switch #1 and #2 setting to the “OFF” position. DO NOT alter any other DIP Switch. (The LED on the PCB and the display of the remote control stops illuminating.)
(13) Attach the unit’s front cover.
(14) Turn on the gas shutoff valve and water shutoff valve.
(15) Check and ensure safe operation and performance of the water heater.



Sea Level Chip for PC Board.

Notice: A different Sea Level Chip is required for Indoor, Outdoor and Direct Vent models, types of gas and serial number. Check the number on the Sea Level Chip. (Refer to the table comes with the chip.)

Notice: When the water heater is installed at the high altitude (above 3,280 feet) (0 ~ 1,000 m), adjust the high altitude chip according to the High Altitude DIP Switch Adjustment.

Instruction for replacing Upper Burner Assembly:

WARNING: Improper adjustment, alteration, service or maintenance can cause property damage, personal injury, or death.

Adjustment for Upper Burner Assembly.:

WARNING: Without the adjustment, the water heater may not function properly.

WARNING: After replacing the front plate, check for gas leakage. Then, test ignition. Make sure that there is no gas leakage.

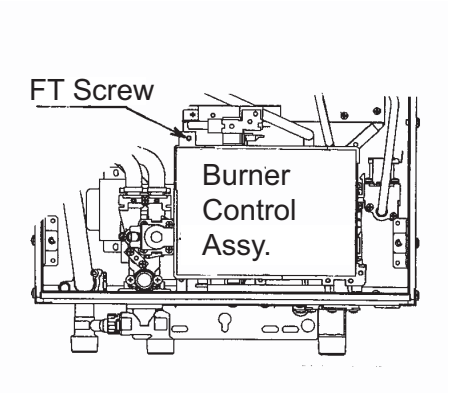
Notice: When replacing the Upper Burner Assembly by using the Upper Burner Kit (listed below) for the water heater with the serial number before 06-09-xxxxxx, be careful that the position of the Igniter Electrode and the Flame Rod Electrode was changed.

31-52577 for PH-28RIFS-0 & -1 (Old) and PH-28CIFS-0 & -1 (Old)
31-52576 for PH-28ROF-0 & -1 (Old) and PH-28COF-0 & -1 (Old)
31-52578 for PH-28RDVSN-0 & -1 (Old) and PH-28CDVSN-0 & -1 (Old)
31-52579 for PH-28RDVSP-0 & -1 (Old) and PH-28CDVSP-0 & -1 (Old)

Note: If the water heater has the serial number after 06-10-xxxxxx, the different Upper Burner Kit may be required.

How to replace the Upper Burner Assembly:

1. Disconnect the electric power to the water heater. Turn off the gas shutoff valve and water shutoff valve.
2. Remove the front cover.
3. Burner Control Assembly (PC Board) Removal:
   (1) Pull out all connectors that are connected the Burner Control Assembly (PC Board).
   (2) Remove one (1) FT screw that holds the PC Board in place.

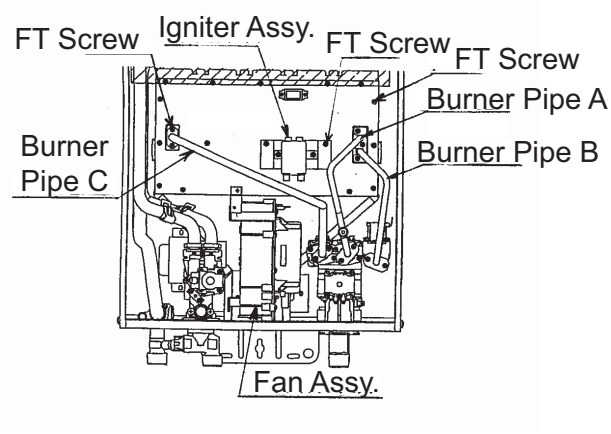


4. Front Plate Removal:
   (1) Remove two (2) FT screws that attach the Igniter Holder to the Front Plate.
   (2) Remove two (2) FT screws that hold the Air Filter SW Assembly to the Front Plate. (Indoor Model Only)
   (3) Loosen six (6) FT screws that connect three (3) Flange B to the Gas Control Valve Assembly.
   (4) Remove two (2) FT screws that connect Flange A to Lower Burner Assembly L and remove three (3) FT screws that connect Flange C to Lower Burner Assembly R.
   (5) Pull Burner Pipe C from Lower Burner Assembly L and pull Burner Pipes A and B from Lower Burner Assembly R.

Continue to the next page.

(6) Pivot Burner Pipes A, B, C so that they are not in front of the Front Plate.
(7) Remove fourteen (14) FT screws that hold the Front Plate in place.

5. Main Burner Assembly Removal:
(1) Pull off the two (2) wires from the Igniter Electrodes and pull off the white wire from the Flame Rod Electrode in the front.
(2) Remove three (3) FT screws that are located under the Upper Burner Assembly.
(3) Slide the Main Burner Assembly from the combustion chamber.
(4) Pull off red and blue wires from Flame Rod Electrodes in the back.



(5) Remove two (2) FT screws attaching Lower Burner Assembly L to Upper Burner Assembly. Remove two (2) FT screws attaching Lower Burner Assembly R to Upper Burner Assembly.

6. Main Burner Assembly Replacement:
(1) Attach Left and Right Lower Burner Assembly to new Upper Burner Assembly.
(2) Connect red and blue wires to Flame Rod Electrodes in the back of the Upper Burner Assembly. Red wire connects to right electrode and blue wire connects to left electrode.
(3) Slide the Main Burner Assembly into the combustion chamber.
(4) Replace three (3) screws that are located under the Upper Burner Assembly.
(5) Replace the two wires to the Igniter Electrodes (left and right) and the white wire to the Flame Rod Electrode on the middle in the front. (Refer to illustration on the next page.)

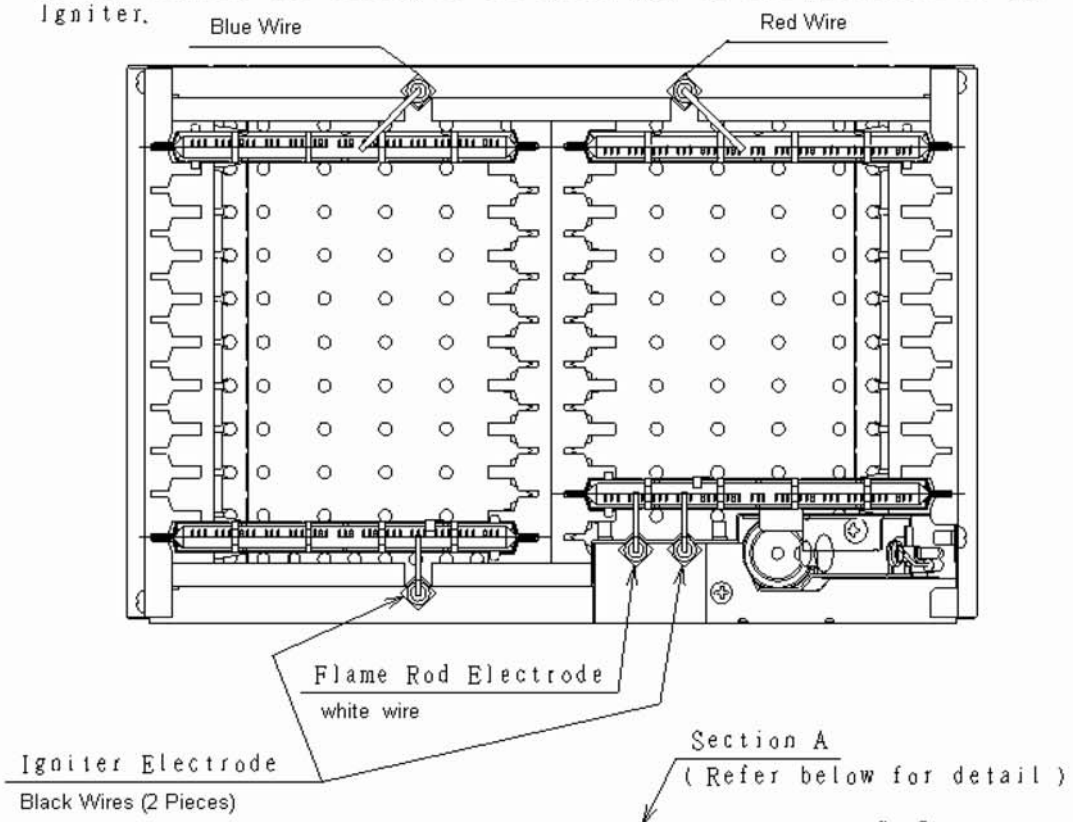
7. Front Plate Replacement:
(1) Replace the new front plate and thirteen (13) screws around its perimeter. Remember to attach grounding wire to one of these screws. Do not attach Air Filter SW Assembly yet.
(2) Pivot Burner Pipes A, B and C back into place.
(3) Replace flanges and screws that connect the burner pipes to the Lower Burner Assembly.
(4) Tighten the screws holding the burner pipes to the Gas Control Valve Assembly.
(5) Replace Air Filter SW Assembly and two screws connecting it to the front plate.
(6) Replace Igniter Holder and two screws holding it in place.
(7) Replace remaining screw.

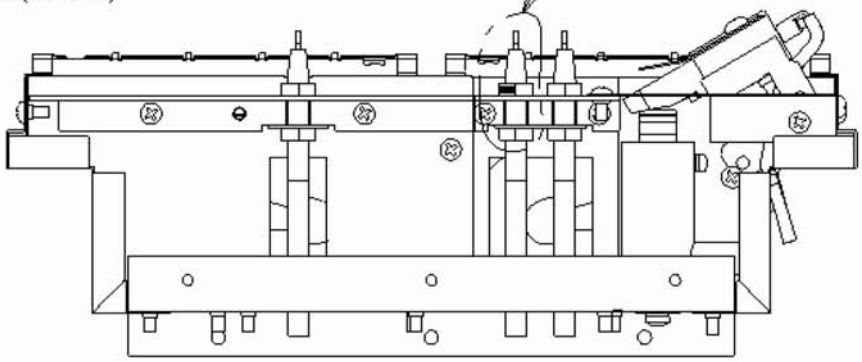
8. Burner Control Assembly (PC Board) Replacement:
(1) Replace Burner Control Assembly (PC Board) and screw that holds it in place.
(2) Reconnect all connectors to their matching slots.

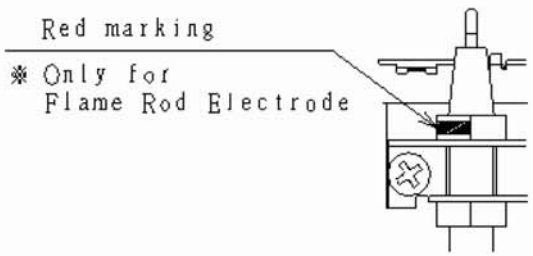
9. Attach the unit's front cover.
10. Turn on the gas shutoff valve and water shutoff valve.
11. Make sure that there is no gas leakage in connections.
12. Check and ensure safe operation and performance of the water heater.

Caution:When the replacement of the Burner Assembly.

When the replacement of the Burner Assembly, connect the wiring of the Flame Rod to the Electrode with the red marking underneath. Do not connect the wiring of the Flame Rod to the Electrode of the Igniter.



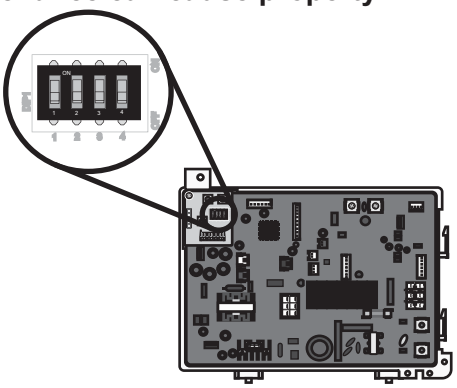




Section A
(Flame Rod Electrode)

Instruction for changing the setting to 140°F (60°C) for Residential Models:

WARNING: Improper adjustment, alternation, service or maintenance can cause property damage, personal injury, or death.



Location of DIP Switch on PC Board.

Temperature Setting DIP Switch Adjustment

Required adjustment for up to 140°F (60°C) water temperature settings -

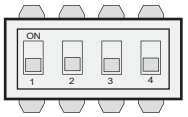
Can be achieved only when using MAIN remote control.

DO NOT alter the #4 DIP Switch if the setting of up to 140°F (60°C) is not required.

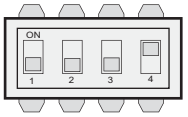
Follow the instruction below if it is determined that a setting of up to 140°F (60°C) is required.

(1) Turn off remote controls. Turn off the gas and water shutoff valves.
(2) Remove the front cover.
(3) Find the DIP Switch #4 located at the top left hand side of the PCB. (See illustration to the right for DIP Switch location)
(4) Change the DIP Switch #4 setting to the "ON" position. DO NOT alter any other DIP Switch. (The LED on the PCB is flashing. At the same time, the display of the Main Remote Control starts to flash.)
(5) Press the "Max." Button on the left hand side of the PCB for more than 1 second. (The LED on the PCB starts illuminating continuously. At the same time, the display of the Main Remote Control is on continuously.)
(6) Change the DIP Switch #4 setting back to the "OFF" position. DO NOT alter any other DIP Switch. (The LED on the PCB will stop illuminating. At the same time, the display of the Main Remote Control will turn off.)
(7) Attach the unit's front cover.
(8) Turn on the remote controls, gas and water shutoff valves.
(9) Check and ensure safe operation and performance of the water heater.

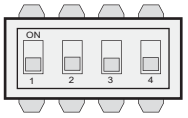
See the next page for procedure to LIMIT maximum water temperature setting to 120°F (49°C).



As set from factory

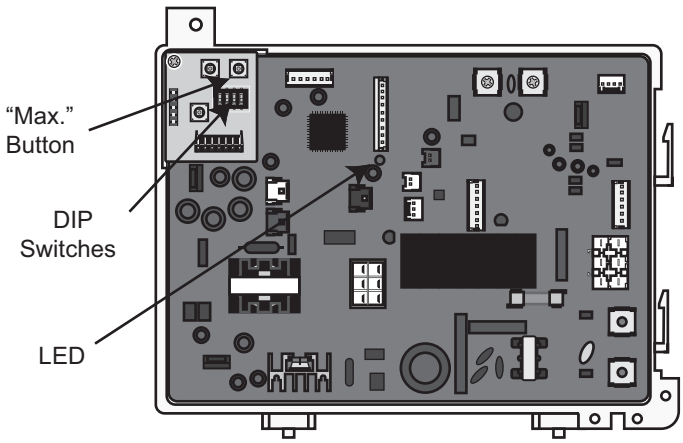


Setting during adjustment to DIP Switch #4 for temperature.



Setting after adjustment to DIP Switch #4 for temperature.

WARNING: Water temperature over 125°F (52°C) can cause severe burns instantly or death from scalds. Children, disabled and elderly are at highest risk of being scalded. See the Instruction Manual before setting the temperature on the remote control. FEEL WATER BEFORE BATHING OR SHOWERING.
DO NOT leave a child in the bath unsupervised.



Notice: The Main Remote Control display shows 125°F (52°C), 130°F (54°C), 135°F (57°C) and 140°F (60°C) after "120°F (49°C)" setting.

Notice: For safety reasons the BATH Remote Control(s) cannot be adjusted to temperature above 120°F (49°C).

WARNING: DO NOT alter any other DIP Switch.

WARNING: Change this setting to 140°F (60°C) is done at your own risk.

Danger: Hotter water increases the potential for Hot Water SCALDS.

Note: We recommend that you install the thermostatically controlled tub and shower valve & tempering valve for your safety.

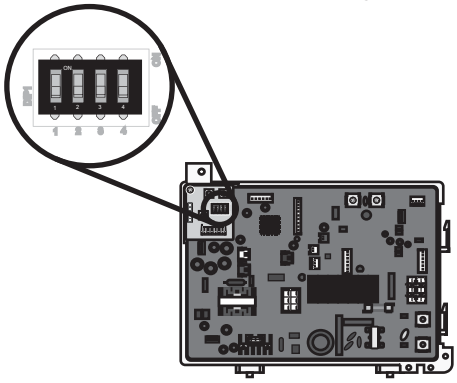
Time/Temperature Relationship in Scalds

Temperature	Time to Produce Serious Burn	Temperature	Time to Produce Serious Burn
120°F (49°C)	More than 5 minutes	140°F (60°C)	Less than 5 seconds
125°F (52°C)	1-1/2 to 2 minutes	145°F (63°C)	Less than 3 seconds
130°F (54°C)	About 30 seconds	150°F (66°C)	About 1-1/2 seconds
135°F (57°C)	About 10 seconds	155°F (68°C)	About 1 second

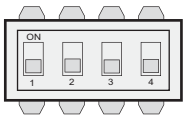
Table courtesy of The Shriners Burn Institute

Instruction for changing the setting to 180°F (82°C) for Commercial Models:

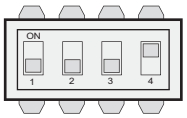
WARNING: Improper adjustment, alternation, service or maintenance can cause property damage, personal injury, or death.



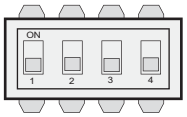
Location of DIP Switch on PC Board.



As set from factory



Setting during adjustment to DIP Switch #4 for temperature.



Setting after adjustment to DIP Switch #4 for temperature.

Temperature Setting DIP Switch Adjustment

Required adjustment for up to 180°F (82°C) water temperature settings -

Can be achieved only when using MAIN remote control.

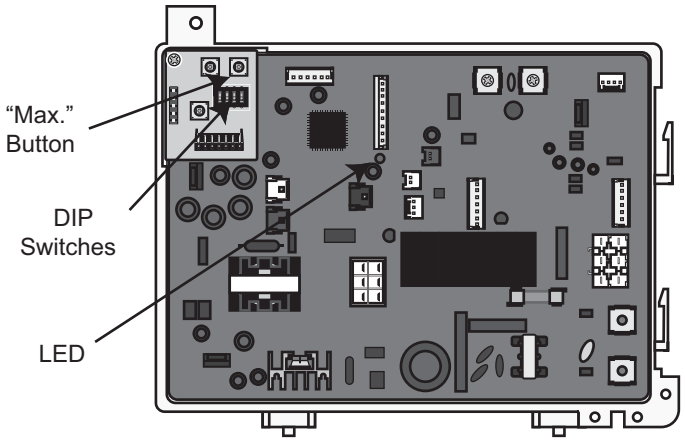
DO NOT alter the #4 DIP Switch if the setting of up to 180°F (82°C) is not required.

Follow the instruction below if it is determined that a setting of up to 180°F (82°C) is required.

(1) Turn off remote controls. Turn off the gas and water shutoff valves.
(2) Remove the front cover.
(3) Find the DIP Switch #4 located at the top left hand side of the PCB. (See illustration to the right for DIP Switch location)
(4) Change the DIP Switch #4 setting to the “ON” position. DO NOT alter any other DIP Switch. (The LED on the PCB is flashing. At the same time, the display of the Main Remote Control starts to flash.)
(5) Press the “Max.” Button on the left hand side of the PCB for more than 1 second. (The LED on the PCB starts illuminating continuously. At the same time, the display of the Main Remote Control is on continuously.)
(6) Change the DIP Switch #4 setting back to the “OFF” position. DO NOT alter any other DIP Switch. (The LED on the PCB will stop illuminating. At the same time, the display of the Main Remote Control will turn off.)
(7) Attach the unit’s front cover.
(8) Turn on the remote controls, gas and water shutoff valves.
(9) Check and ensure safe operation and performance of the water heater.

See the next page for procedure to LIMIT maximum water temperature setting to 120°F (49°C).

WARNING: Water temperature over 125°F (52°C) can cause severe burns instantly or death from scalds. Children, disabled and elderly are at highest risk of being scalded. See the Instruction Manual before setting the temperature on the remote control. FEEL WATER BEFORE BATHING OR SHOWERING.
DO NOT leave a child in the bath unsupervised.



Notice: The Main Remote Control display shows 125°F (52°C), 130°F (54°C), 135°F (57°C), 140°F (60°C), 150ºF (66ºC), 160ºF (71ºC), 170ºF (77ºC) and 180ºF (82ºC) after “120°F (49°C)” setting.

Notice: For safety reasons the BATH Remote Control(s) cannot be adjusted to temperature above 120°F (49°C).

WARNING: DO NOT alter any other DIP Switch.

WARNING: Change this setting to 180°F (82°C) is done at your own risk.

Danger: Hotter water increases the potential for Hot Water SCALDS.

Note: We recommend that you install the thermostatically controlled tub and shower valve & tempering valve for your safety.

Time/Temperature Relationship in Scalds

Temperature	Time to Produce Serious Burn	Temperature	Time to Produce Serious Burn
120°F (49°C)	More than 5 minutes	140°F (60°C)	Less than 5 seconds
125°F (52°C)	1-1/2 to 2 minutes	145°F (63°C)	Less than 3 seconds
130°F (54°C)	About 30 seconds	150°F (66°C)	About 1-1/2 seconds
135°F (57°C)	About 10 seconds	155°F (68°C)	About 1 second

Table courtesy of The Shriners Burn Institute

Instruction for changing the setting back to 120°F (49°C):

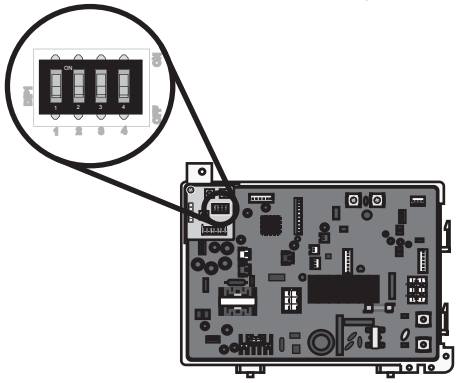
WARNING: Improper adjustment, alternation, service or maintenance can cause property damage, personal injury, or death.

Temperature Setting DIP Switch Adjustment

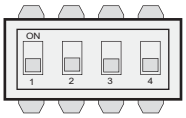
Required adjustment to LIMIT maximum water temperature setting to 120°F (49°C) -

Follow the instruction below if it is determined that a setting of up to 140°F (60°C) or 180ºF (82ºC) is no longer required.

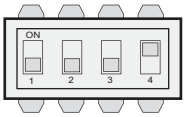
(1) Turn off remote controls. Turn off the gas and water shutoff valves.
(2) Remove the front cover.
(3) Find the DIP Switch #4 located at the top left hand side of the PCB. (See illustration to the right for DIP Switch location)
(4) Change the DIP Switch #4 setting to the “ON” position. DO NOT alter any other DIP Switch. (The LED on the PCB is on. At the same time, the display of the Main Remote Control is on continuously.)
(5) Press the “Min.” Button on the left hand side of the PCB for more than 1 second. (The LED on the PCB starts flashing. At the same time, the display of the Main Remote Control starts to flash.)
(6) Change the DIP Switch #4 setting back to the “OFF” position. DO NOT alter any other DIP Switch. (The LED on the PCB will stop flashing. At the same time, the display of the Main Remote Control will turn off.)
(7) Attach the unit’s front cover.
(8) Turn on the remote controls, gas and water shutoff valves.
(9) Check and ensure safe operation and performance of the water heater.



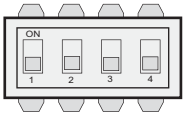
Location of DIP Switch on PC Board.



As set from factory

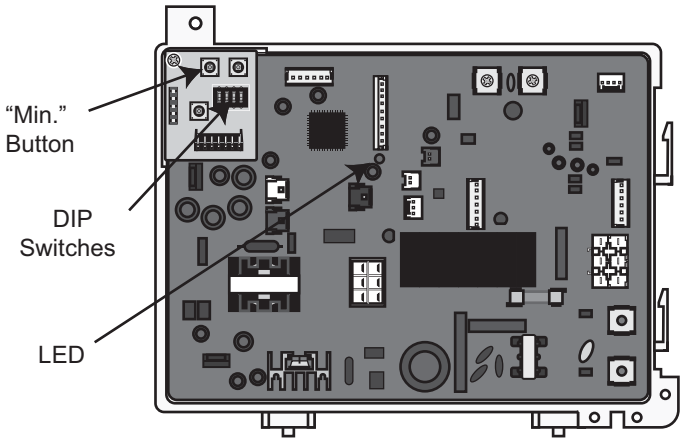


Setting during adjustment to DIP Switch #4 for temperature.



Setting after adjustment to DIP Switch #4 for temperature.

WARNING: Water temperature over 125°F (52°C) can cause severe burns instantly or death from scalds. Children, disabled and elderly are at highest risk of being scalded. See the Instruction Manual before setting the temperature on the remote control. FEEL WATER BEFORE BATHING OR SHOWERING.
DO NOT leave a child in the bath unsupervised.



Danger: Hotter water increases the potential for Hot Water SCALDS.

Notice: For safety reasons the BATH Remote Control(s) cannot be adjusted to temperature above 120°F (49°C).

WARNING: DO NOT alter any other DIP Switch.

WARNING: Change the setting to 140°F (60°C) or 180ºF (82ºC) is done at your own risk.

Note: The maximum water temperature is set at 100°F (38°C) from the factory.

Note: We recommend that you install the thermostatically controlled tub and shower valve & tempering valve for your safety.

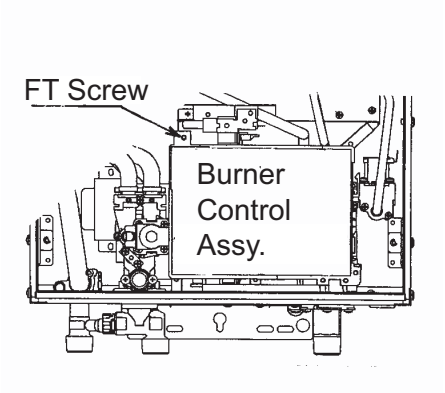
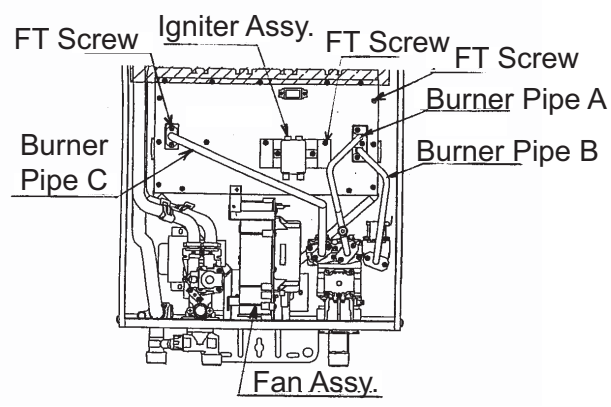
Time/Temperature Relationship in Scalds

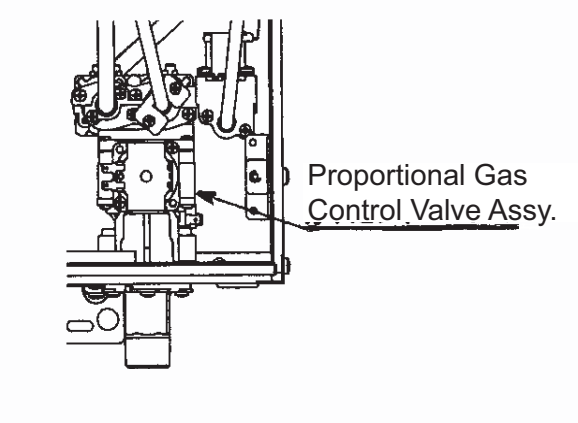
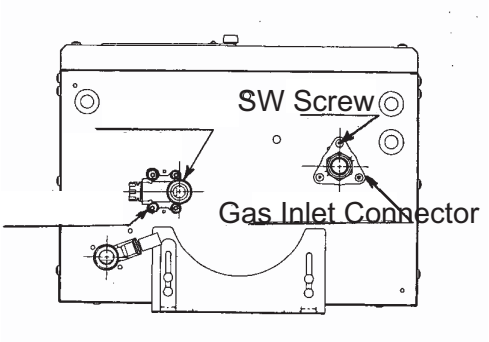
Temperature	Time to Produce Serious Burn	Temperature	Time to Produce Serious Burn
120°F (49°C)	More than 5 minutes	140°F (60°C)	Less than 5 seconds
125°F (52°C)	1-1/2 to 2 minutes	145°F (63°C)	Less than 3 seconds
130°F (54°C)	About 30 seconds	150°F (66°C)	About 1-1/2 seconds
135°F (57°C)	About 10 seconds	155°F (68°C)	About 1 second

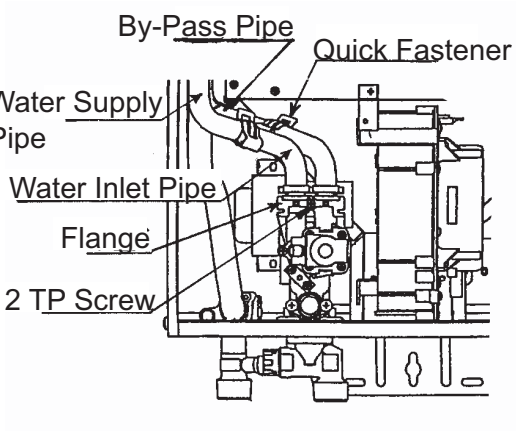
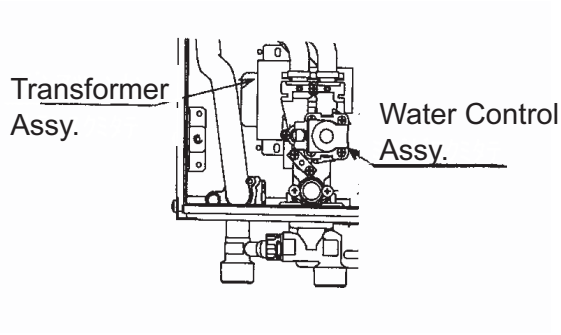
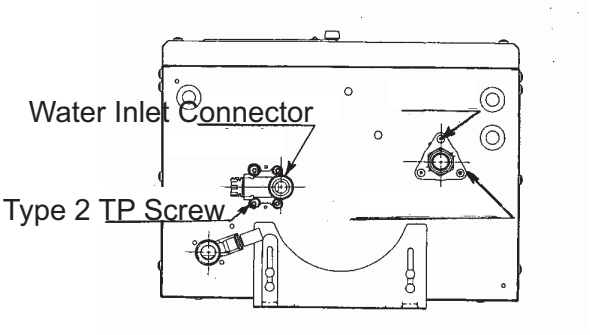
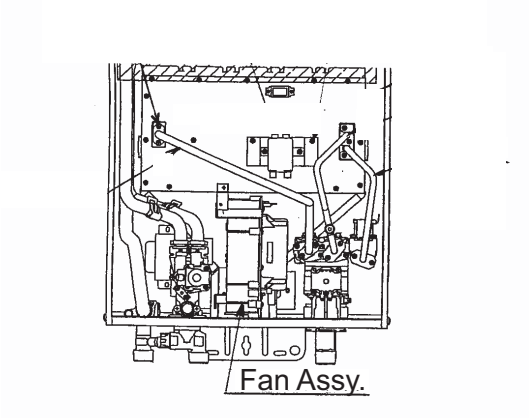
Table courtesy of The Shriners Burn Institute

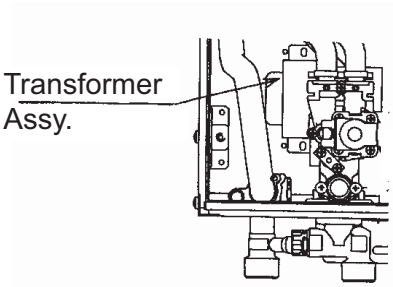
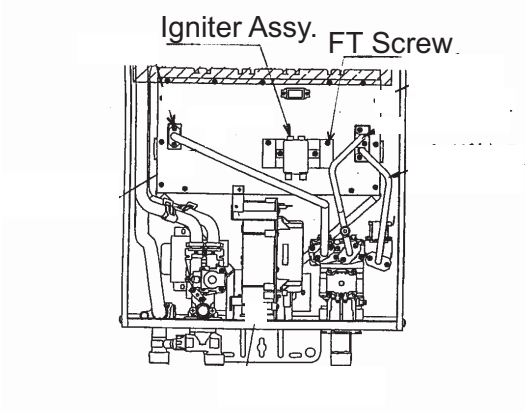
HOW TO DISASSEMBLE EACH PARTS

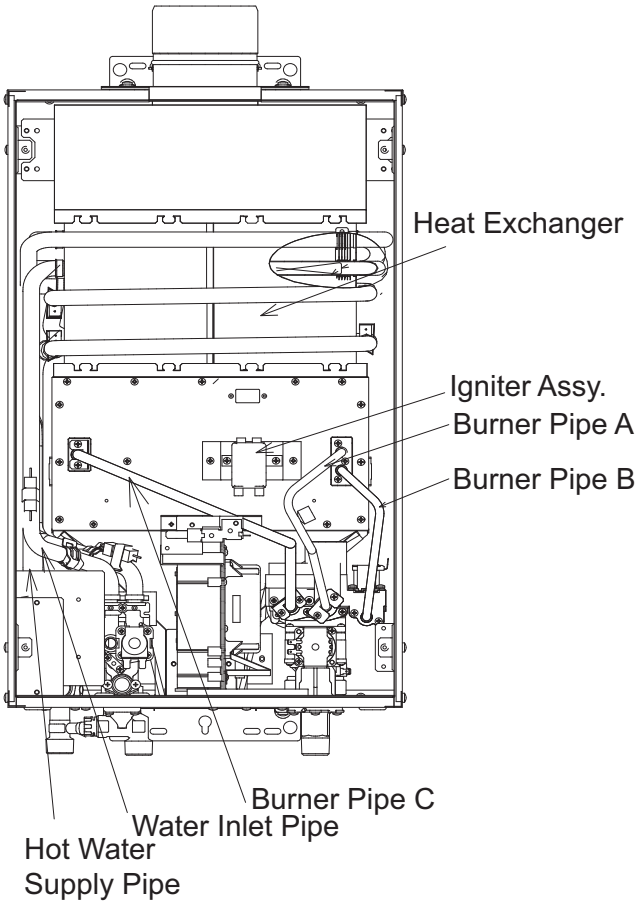
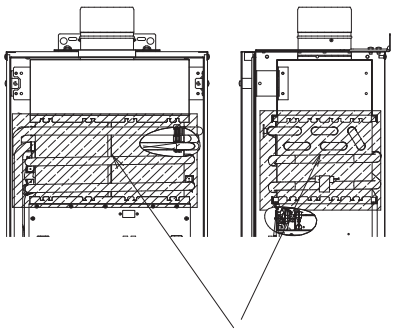
(1) When performing maintenance and/or servicing the water heater, before disassembling, always turn off the electric power, gas shutoff valve and water shutoff valve. Wait for the water heater to become cool. Be careful to avoid injury to your fingers.
(2) Drain all water from the water heater when disassemble the water parts.
(3) Before any disassembly, make sure what the problem is. Disassemble only the parts needed.
(4) Handle all parts carefully.
(5) When reassembling, take caution for any alien substance, i.e. dust, etc.
(6) After reassembling, check for gas and water leakage. Then, test ignition. Make sure that there is no gas leakage in connections by testing with bubble solution. Bubbles indicates a gas leak that must be corrected.
(7) Check the performance, capacity and operation after servicing.

Process	Illustration
[1] How To Remove Burner Control Assy. (#723): Burner Control Assembly (#723) Removal: 1. Pull out all wirings that are connected to the burner control assembly. 2. Remove one (1) FT screw that holds the burner control assembly. 3. Remove burner control assembly.	
[2] How To Remove Main Burner (#112,113,114): (1) Front Plate (#730) Removal: 1. Remove two (2) FT screws for the igniter assy. (#123) that is fixed to the front plate (#730) and the, remove igniter assy. (#123). 2. Remove eleven (11) FT screws that hold burner pipe A (#138), burner pipe B (#141) and burner pipe C (#140) and then, remove them. 3. Remove sixteen (16) FT screws that hold the front plate (#730). (One screw is also used for grounding wire.) 4. Remove front plate (#730). Continue to the next page.	

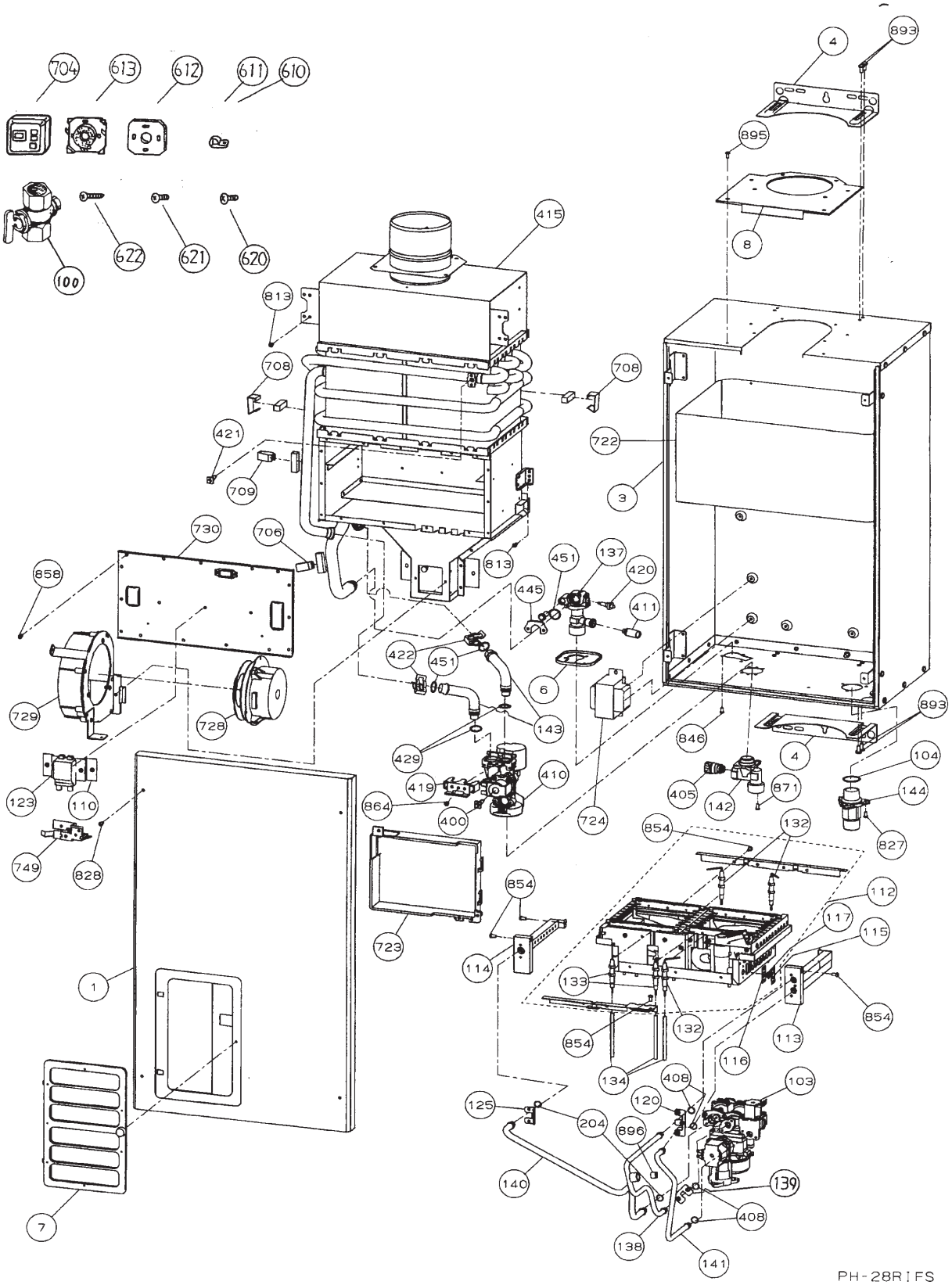
Process	Illustration
[2] How To Remove Main Burner: Continue from the previous page. (2) Main Burner Assy. (#112, 113,114) Removal: 1. Pull out three (3) wires for electrode (#132,133) in front side. 2. Remove Three (3) Ft screws that are located under the upper burner assy. (#112). 3. Remove the main burner assy. (as upper burner assy. (#112) and lower burner assy. (#113,114) in one piece) from combustion chamber. 4. Remove FT screws (each two (2) screws right and left) that are fixed upper burner assy. (#112) and lower burner assy. (R & L). (#113,114) (Separate the upper burner and lower burner.)	Refer to the electrode (#132,133) in the Schematic Disassembly. Refer to the upper burner assy. (#112), lower burner assy. R (#113) and lower burner assy. L (114) in the Schematic Disassembly.
[3] How To Remove Proportional Gas Control Valve Assembly (#103): (1) Burner Control Assy. (#723) Removal: Remove burner control assy. (#723) by referring to [1] - 1, 2 & 3. (2) Burner Pipe A (#138), Burner Pipe B (#141) and Burner Pipe C (#140) Removal: Remove burner pipe A, burner pipe B and burner pipe C by referring to [2] - (1) 2. (3) Gas Inlet Connector (#144) Removal: 1. Remove three (3) SW screws that hold the gas inlet connector (#144). 2. Pull out the wiring that is connected to the proportional gas control valve assembly. 3. Remove proportional gas control valve assy. (#103)	 

Process	Illustration
[4] How To Remove Water Control Assembly (#410): (1) Burner Control Assy. (#723) Removal: Remove burner control assy. (#723) by referring to [1] - 1, 2 & 3. (2) Water Inlet Pipe Assy. (#143) Removal: 1. Remove two (2) quick fasteners (#422) that are connected to the water supply pipe, by-pass pipe and water inlet pipe. 2. Remove one (1) type 2 TP screw that is fixed to the flange (#419)and then, remove flange (#419). 3. Remove two (2) water inlet pipes (#143) (3) Water Inlet Connector (#142) Removal: 1. Remove four (4) type 2 TP screws for water inlet connector (#142) . 2. Pull out the wiring that is connected to the water control assy. and then, remove water control assy. (#410)	  
[5] How To Remove Fan Assy. (#728,729): (1) Burner Control Assy. (723) Removal: Remove burner control assy. (#723) by referring to [1] - 1, 2 & 3. (2) Remove the wirings that are connected to fan assy. (3) Remove three (3) pan head screws that are fixed to fan assy. (4) Remove fan assy. (#728,729)	 Also, refer to the fan assy. (#728) and Fan Case Assy. B (#729) in the Schematic Disassembly.

Process	Illustration
[6] How To Remove Transformer Assy. (#724): (1) Burner Control Assembly (#723) Removal: Remove burner control assy. (#723) by referring to [1] - 1, 2 & 3. (2) Water Control Assembly (#410) Removal: Remove water control assy. (#410) by referring to [4] - (2) 1, 2 & 3 and [4] - (3) 1 & 2. (3) Transformer Assembly (#724) Removal: 1. Remove two (2) pan head screws that are fixed the transformer assy. 2. Remove transformer assy. (#724)	 Also, refer to the transformer assy. (#724) in the Schematic Disassembly.
[7] How To Remove Igniter Assembly (#123): (1) Remove two (2) pan head screws that are fixed the igniter assy. (#123) and then, remove igniter assy. (#123) from igniter holder (#110).	 Also, refer to the igniter assy. (#123), igniter holder (#110) and front plate (730) in the Schematic Disassembly.

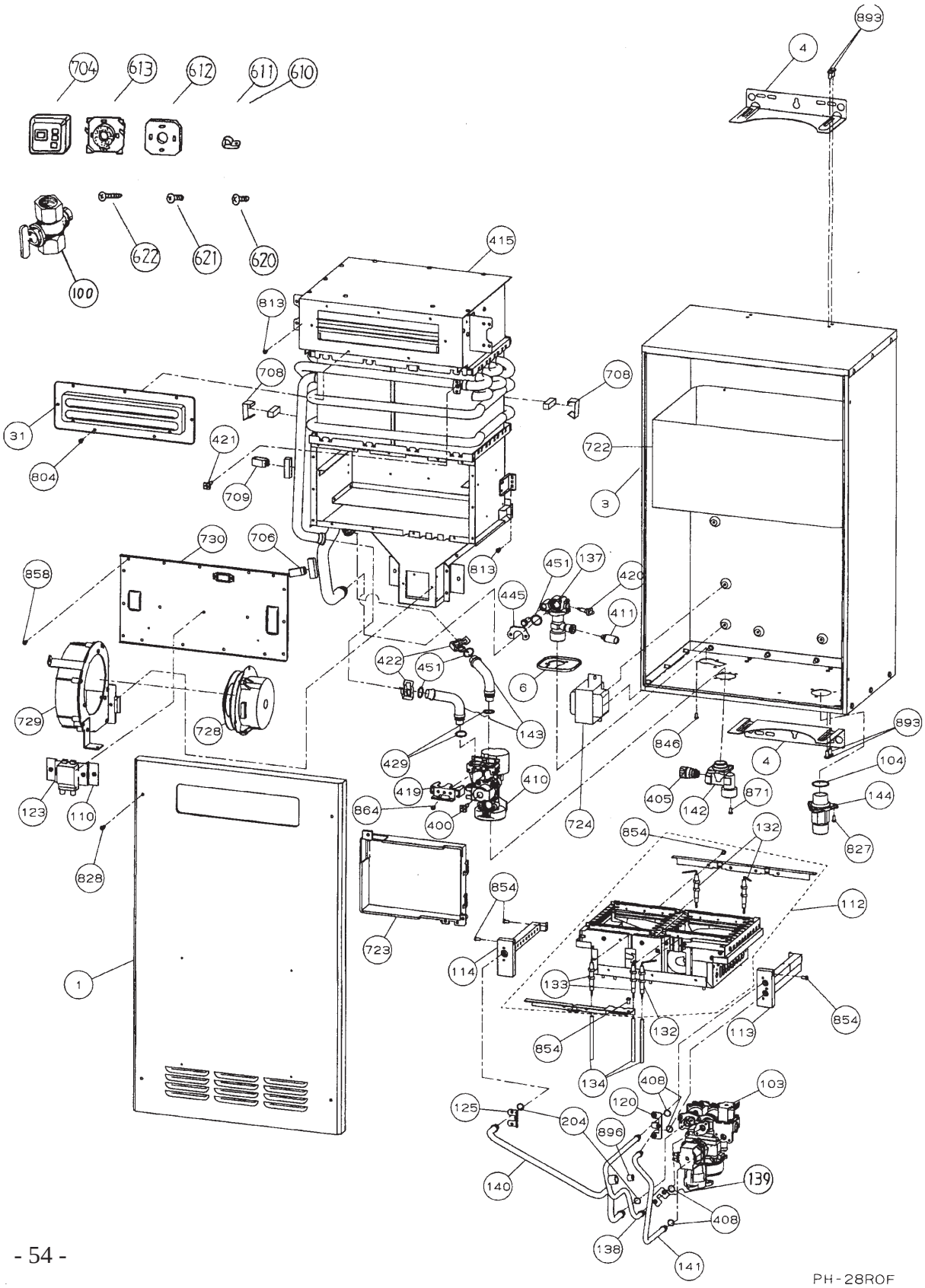
Process	Illustration
[9] How To Remove Heat Exchanger (#415): (1) Burner Control Assy. (#723) Removal: Remove burner control assy. (#723) by referring to [1] - 1, 2 & 3. (2) Burner Pipe A (#138), Burner Pipe B (#141) and Burner Pipe C (#140) Removal: Remove burner pipe A, burner pipe B and burner pipe C by referring to [2] - (1) 2. (3) Igniter Assy. (#123) Removal: Remove igniter assy. (#123) by referring to [7] - (1). (4) Water Inlet Pipe Assy. (#143) Removal: Remove water inlet pipe assy. (#143) by referring to [4] - (2) 1, 2 & 3. (5) Hot Water Supply Pipe Removal: 1. Remove two (2) screws that are fixed hot water outlet connector (#137) and flange (#445) and then, remove flange (#445). 2. Remove hot water supply pipe. (6) Remove eight (8) FT screws for back cover support plate (#8) and then, remove back cover support plate (#8). (7) Remove four (4) pan head screws for flue terminal, two (2) pan head screws for inner case part and two (2) pan head screws for air intake lower part that are fixed heat exchanger (#415) and then, remove heat exchanger (#415).	 Also, refer to the back cover support plate (#8), FT screws (#895), heat exchanger (#415) and screws (#813) in the Schematic Disassembly. [For Outdoor Model] The process is same expect (6) and (7) (four (4) pan head screws for flue terminal).
[9] How To Remove Film Type OHL(#722): (1) Remove heat exchanger (#415) by referring to [9] (1) ~ (7). (2) Pull the wiring connector for the film type OHL. (3) Remove film type OHL (#722).	

Schematic Disassembly (PH-28RIFS)



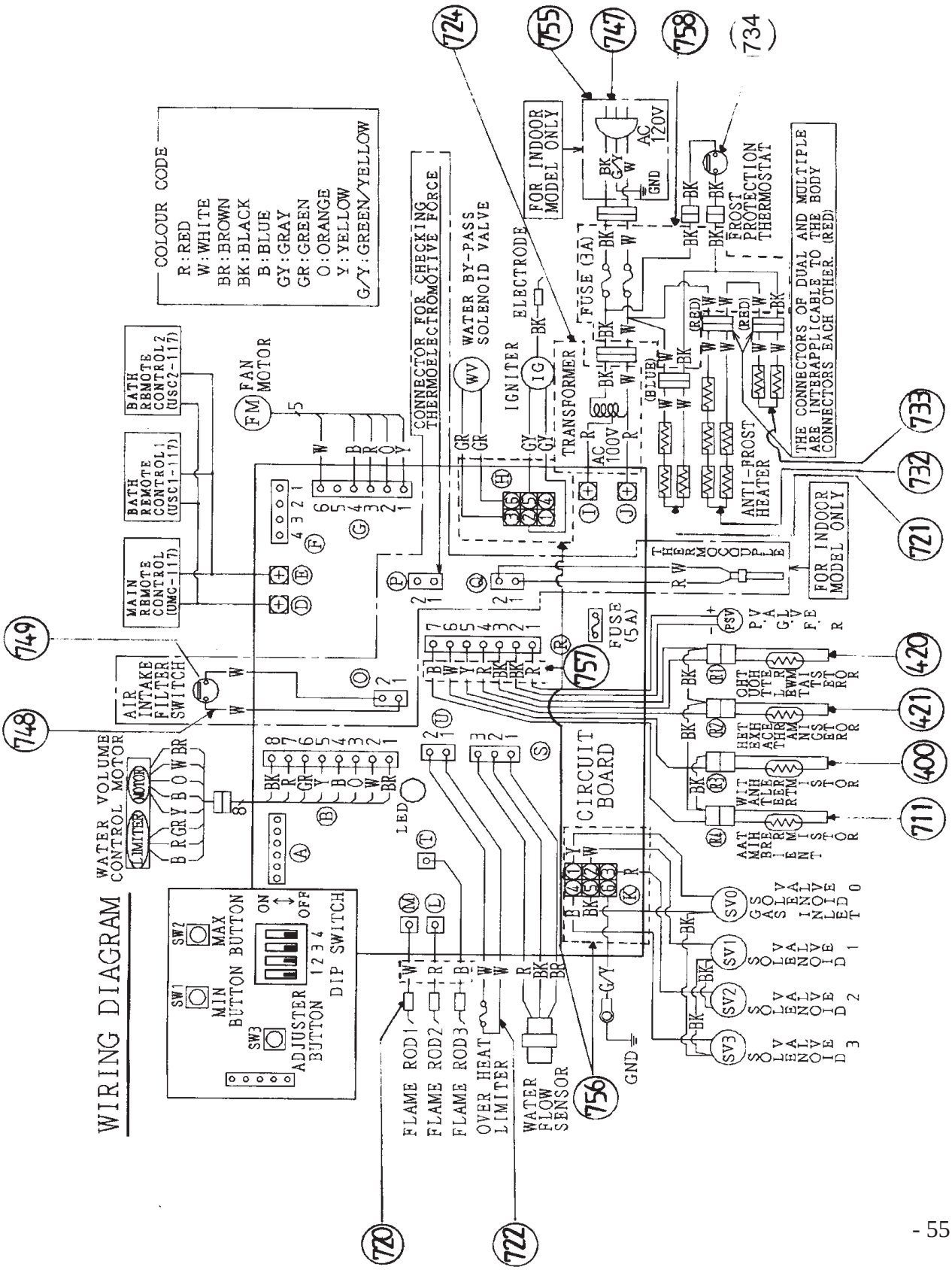
PH-28RIFS

Schematic Disassembly (PH-28ROF)



PH-28ROF

Schematic Disassembly (PH-28RIFS & PH-28ROF)



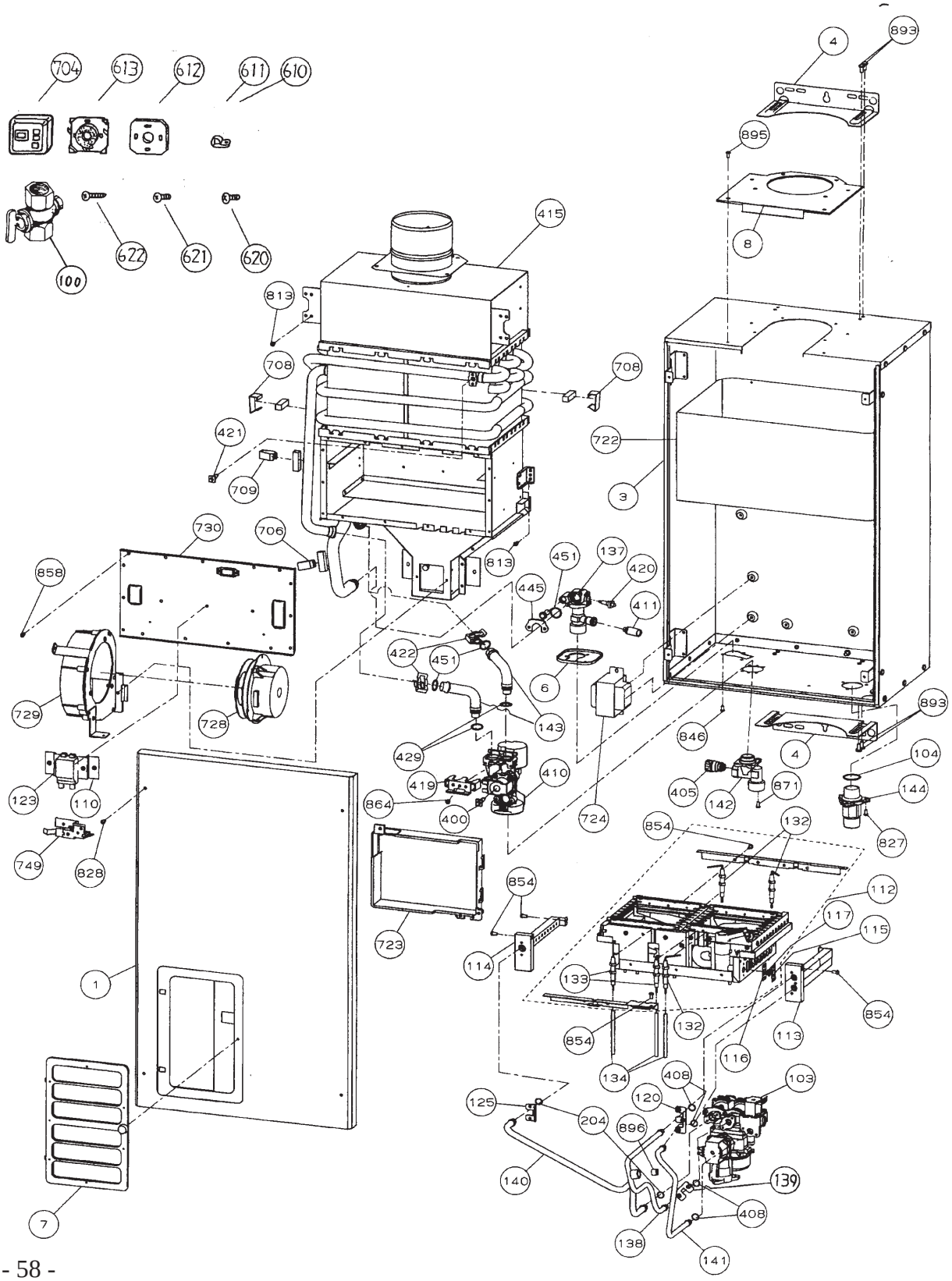
Parts List for PH-28RIFS

No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover Assembly			896	Plug for Manifold Pressure
3	Back Cover Assembly	419	Flange		
4	Slide Bracket A	420	Hot Water Outlet Thermistor		
6	Support Plate	421	Heat Exchanger Thermistor		
7	Air Filter Assembly	422	Quick Fastener		
		429	“O” Ring P-12.7		
8	Back Cover Support Plate	445	Flange		
		451	“O” Ring P-16		
100	Gas Shutoff Valve	706	Heater Holder C		
103	Gas Control Valve Assembly	708	Holder		
104	"O" Ring P-26	709	Heater Holder		
110	Igniter Holder	711	Ambient Air Thermistor		
112	Upper Burner Assembly	720	FR Connector Cord Assy.		
113*	Lower Burner Assembly R	721	Freeze Protection Assy. A	610	Nylon Clamp (Large)
114*	Lower Burner Assembly L	722	Film Type OHL	611	Nylon Clamp (Small)
115	Sensor Damper Holder	723	Burner Control Assembly	612	Gasket
116	Sensor Damper Plate	724	Transformer Assembly	613	Holder
117*	Sensor Damper	728	Fan Assembly	620	Screw TP 4 x 12 (For 610,611)
120	Flange C	729	Fan Case Assembly B	621	Screw M4 x 6 (For 704)
123	Igniter Assembly	730	Front Plate	622	Screw TP 4 x 16 (For 704)
125	Flange A	733	Freeze Protection Assembly		
132	Electrode (Flame Rod)	734	Thermostat Assembly	704	Bath1 Remote Control Only
133	Electrode (Spark)	747	Power Cord Assembly		
134	Isolated Tube	748	Air Filter SW Connector Cord Assembly		
137	Hot Water Outlet Connector	749	Air Filter SW Assembly		
138	Burner Pipe A	756	Wiring Assembly A		
139	Flange B	757	Signing Connector Cord Assembly		
140	Burner Pipe C	758	Relay Cord Assembly	700	Bath1 Remote Control USC1-117
141	Burner Pipe B	759	Fuse 3A	901	Main Remote Control UMC-117
142	Water Inlet Connector	760	Fuse 5A	903	Bath2 Remote Control USC2-117
143	Water Inlet Pipe Assembly				
144	Gas Inlet Connector Assy.	813	Screw 4 x 8	900	High Altitude Connector
		827	Screw SW M4 x L12	900	Sea Level Connector
204	“O” Ring P-10	828	Screw Gasket		
		846	Screw 4 x 8		
400	Water Inlet Thermistor	854	Screw FT 4 x 8		
405	Drain Valve Assembly	858	Screw FT M4 x 10		
408	“O” Ring P-8	864	Screw 2 TP M4 x L10		
410	Water Control Assembly	871	Screw 2 TP 4 x 18		
411	Drain Valve A	893	Screw FT 5 x 14		
415	Heat Exchanger	895	Screw FT 4 x 10		
		*	Specify NAT. Gas or L.P. Gas		

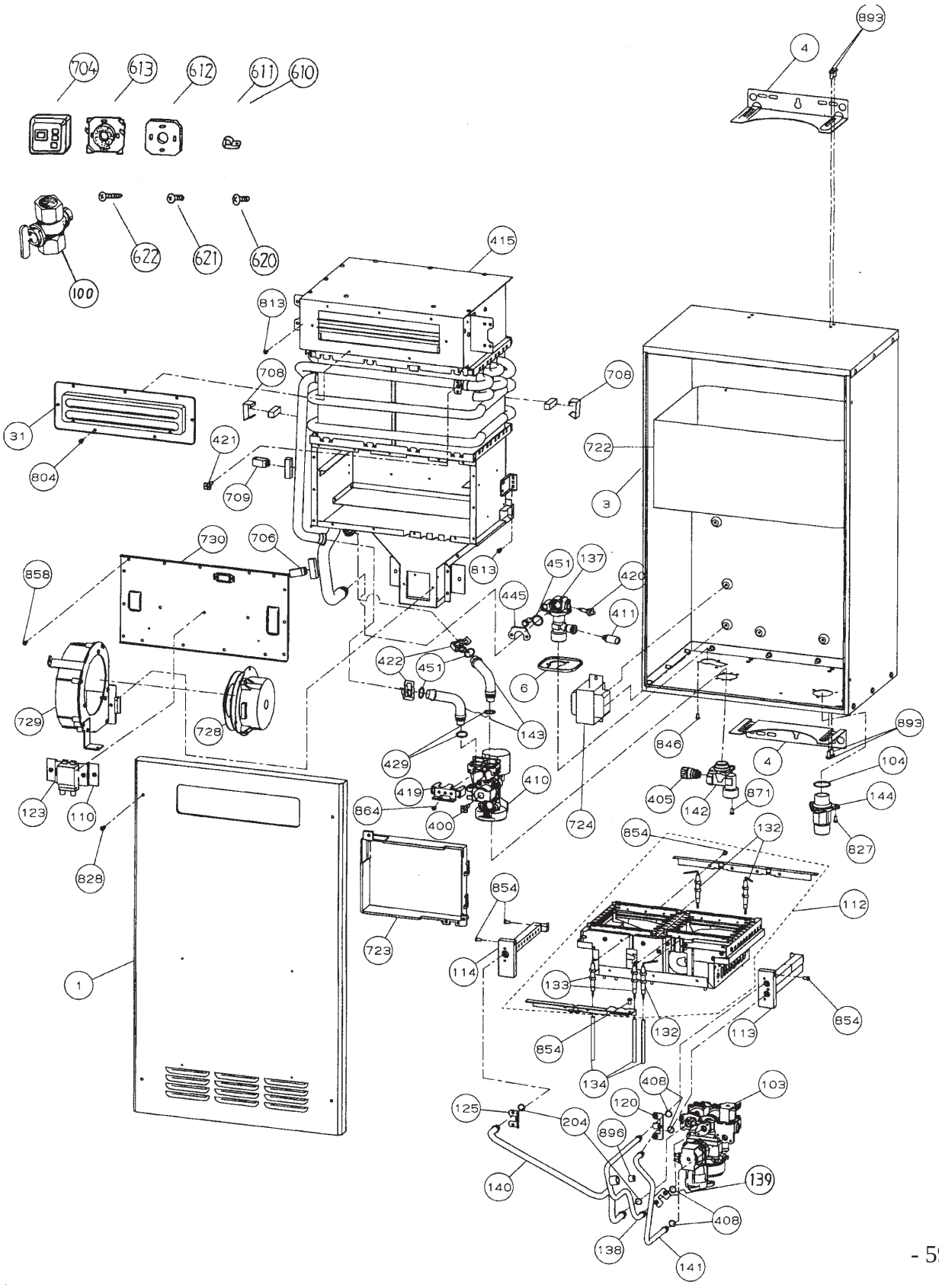
Parts List for PH-28ROF

No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover Assembly			896	Plug for Manifold Pressure
3	Back Cover Assembly	419	Flange		
4	Slide Bracket A	420	Hot Water Outlet Thermistor		
6	Support Plate	421	Heat Exchanger Thermistor		
		422	Quick Fastener		
		429	“O” Ring P-12.7		
31	Flue Outlet	445	Flange		
		451	“O” Ring P-16		
100	Gas Shutoff Valve	706	Heater Holder C		
103	Gas Control Valve Assembly	708	Holder		
104	"O" Ring P-26	709	Heater Holder		
110	Igniter Holder	711	Ambient Air Thermistor		
112	Upper Burner Assembly	720	FR Connector Cord Assy.		
113*	Lower Burner Assembly R	721	Freeze Protection Assy. A	610	Nylon Clamp (Large)
114*	Lower Burner Assembly L	722	Film Type OHL	611	Nylon Clamp (Small)
		723	Burner Control Assembly	612	Gasket
		724	Transformer Assembly	613	Holder
		728	Fan Assembly	620	Screw TP 4 x 12 (For 610,611)
120	Flange C	729	Fan Case Assembly B	621	Screw M4 x 6 (For 704)
123	Igniter Assembly	730	Front Plate	622	Screw TP 4 x 16 (For 704)
125	Flange A	733	Freeze Protection Assembly		
132	Electrode (Flame Rod)	734	Thermostat Assembly	704	Bath1 Remote Control Only
133	Electrode (Spark)				
134	Isolated Tube	755	Power Cord Connector Assembly		
137	Hot Water Outlet Connector				
138	Burner Pipe A	756	Wiring Assembly A		
139	Flange B	757	Signing Connector Cord Assembly		
140	Burner Pipe C	758	Relay Cord Assembly	700	Bath1 Remote Control USC1-117
141	Burner Pipe B	759	Fuse 3A	901	Main Remote Control UMC-117
142	Water Inlet Connector	760	Fuse 5A	903	Bath2 Remote Control USC2-117
143	Water Inlet Pipe Assembly				
144	Gas Inlet Connector Assy.			900	High Altitude Connector
		804	Screw FT 4 x 8	900	Sea Level Connector
204	“O” Ring P-10	813	Screw 4 x 8		
		827	Screw SW M4 x L12		
400	Water Inlet Thermistor	828	Screw Gasket		
405	Drain Valve Assembly	846	Screw 4 x 8		
408	“O” Ring P-8	854	Screw FT 4 x 8		
410	Water Control Assembly	858	Screw FT M4 x 10		
411	Drain Valve A	864	Screw 2 TP M4 x L10		
415	Heat Exchanger	871	Screw 2 TP 4 x 18		
		*	Specify NAT. Gas or L.P. Gas		

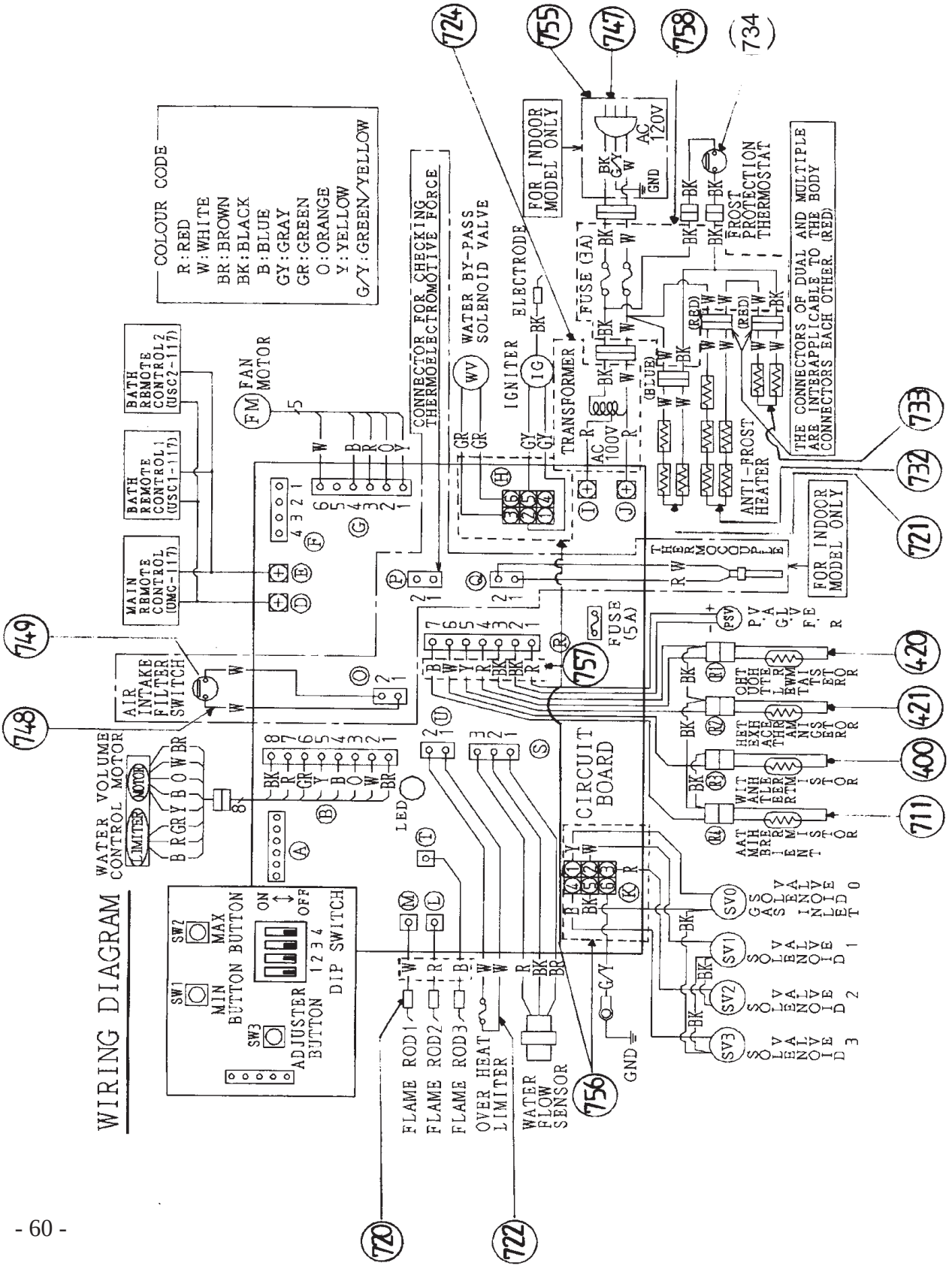
Schematic Disassembly (PH-28CIFS)



Schematic Disassembly (PH-28COF)



Schematic Disassembly (PH-28CIFS & PH-28COF)



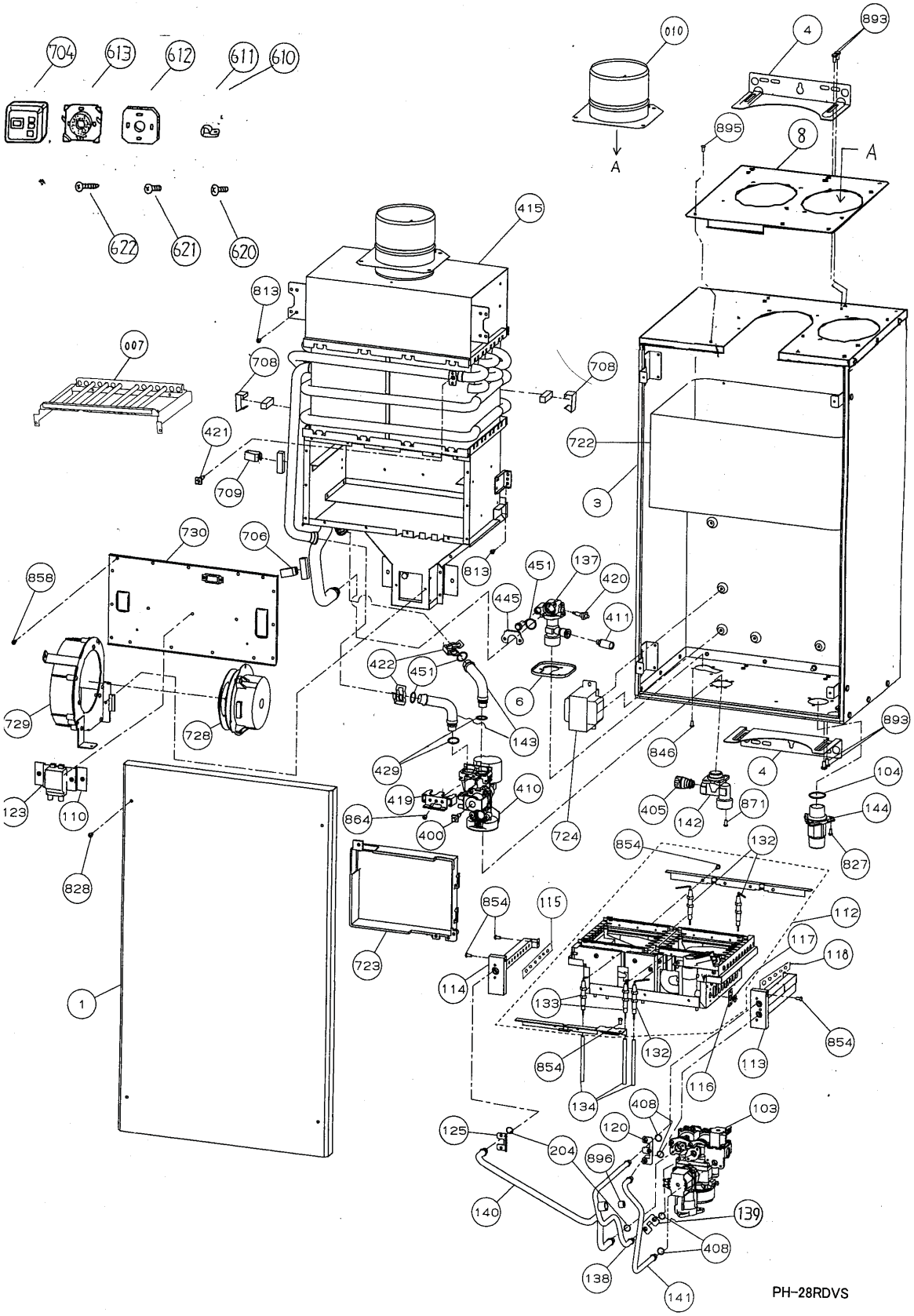
Parts List for PH-28CIFS

No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover Assembly			896	Plug for Manifold Pressure
3	Back Cover Assembly	419	Flange		
4	Slide Bracket A	420	Hot Water Outlet Thermistor		
6	Support Plate	421	Heat Exchanger Thermistor		
7	Air Filter Assembly	422	Quick Fastener		
		429	“O” Ring P-12.7		
8	Back Cover Support Plate	445	Flange		
		451	“O” Ring P-16		
100	Gas Shutoff Valve	706	Heater Holder C		
103	Gas Control Valve Assembly	708	Holder		
104	"O" Ring P-26	709	Heater Holder		
110	Igniter Holder	711	Ambient Air Thermistor		
112	Upper Burner Assembly	720	FR Connector Cord Assy.		
113*	Lower Burner Assembly R	721	Freeze Protection Assy. A	610	Nylon Clamp (Large)
114*	Lower Burner Assembly L	722	Film Type OHL	611	Nylon Clamp (Small)
115	Sensor Damper Holder	723	Burner Control Assembly	612	Gasket
116	Sensor Damper Plate	724	Transformer Assembly	613	Holder
117*	Sensor Damper	728	Fan Assembly	620	Screw TP 4 x 12 (For 610,611)
120	Flange C	729	Fan Case Assembly B	621	Screw M4 x 6 (For 704)
123	Igniter Assembly	730	Front Plate	622	Screw TP 4 x 16 (For 704)
125	Flange A	733	Freeze Protection Assembly		
132	Electrode (Flame Rod)	734	Thermostat Assembly	704	Bath1 Remote Control Only
133	Electrode (Spark)	747	Power Cord Assembly		
134	Isolated Tube	748	Air Filter SW Connector Cord Assembly		
137	Hot Water Outlet Connector	749	Air Filter SW Assembly		
138	Burner Pipe A	756	Wiring Assembly A		
139	Flange B	757	Signing Connector Cord Assembly		
140	Burner Pipe C	758	Relay Cord Assembly	700	Bath1 Remote Control USC1-117
141	Burner Pipe B	759	Fuse 3A	901	Main Remote Control UMC-117
142	Water Inlet Connector	760	Fuse 5A	903	Bath2 Remote Control USC2-117
143	Water Inlet Pipe Assembly				
144	Gas Inlet Connector Assy.	813	Screw 4 x 8	900	High Altitude Connector
		827	Screw SW M4 x L12	900	Sea Level Connector
204	“O” Ring P-10	828	Screw Gasket		
		846	Screw 4 x 8		
400	Water Inlet Thermistor	854	Screw FT 4 x 8		
405	Drain Valve Assembly	858	Screw FT M4 x 10		
408	“O” Ring P-8	864	Screw 2 TP M4 x L10		
410	Water Control Assembly	871	Screw 2 TP 4 x 18		
411	Drain Valve A	893	Screw FT 5 x 14		
415	Heat Exchanger	895	Screw FT 4 x 10		
		*	Specify NAT. Gas or L.P. Gas		

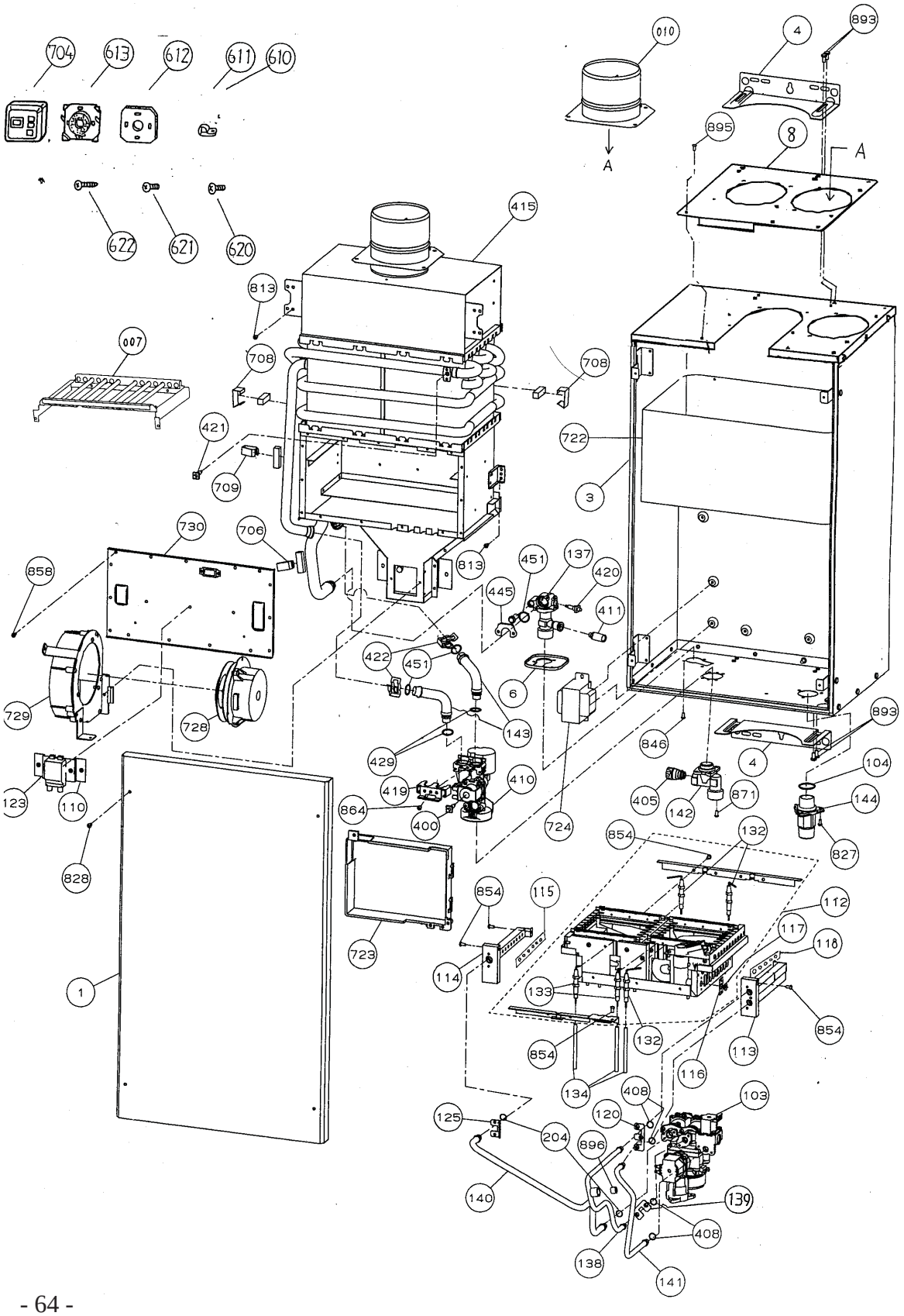
Parts List for PH-28COF

No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover Assembly			896	Plug for Manifold Pressure
3	Back Cover Assembly	419	Flange		
4	Slide Bracket A	420	Hot Water Outlet Thermistor		
6	Support Plate	421	Heat Exchanger Thermistor		
		422	Quick Fastener		
		429	“O” Ring P-12.7		
31	Flue Outlet	445	Flange		
		451	“O” Ring P-16		
100	Gas Shutoff Valve	706	Heater Holder C		
103	Gas Control Valve Assembly	708	Holder		
104	"O" Ring P-26	709	Heater Holder		
110	Igniter Holder	711	Ambient Air Thermistor		
112	Upper Burner Assembly	720	FR Connector Cord Assy.		
113*	Lower Burner Assembly R	721	Freeze Protection Assy. A	610	Nylon Clamp (Large)
114*	Lower Burner Assembly L	722	Film Type OHL	611	Nylon Clamp (Small)
		723	Burner Control Assembly	612	Gasket
		724	Transformer Assembly	613	Holder
		728	Fan Assembly	620	Screw TP 4 x 12 (For 610,611)
120	Flange C	729	Fan Case Assembly B	621	Screw M4 x 6 (For 704)
123	Igniter Assembly	730	Front Plate	622	Screw TP 4 x 16 (For 704)
125	Flange A	733	Freeze Protection Assembly		
132	Electrode (Flame Rod)	734	Thermostat Assembly	704	Bath1 Remote Control Only
133	Electrode (Spark)				
134	Isolated Tube	755	Power Cord Connector Assembly		
137	Hot Water Outlet Connector				
138	Burner Pipe A	756	Wiring Assembly A		
139	Flange B	757	Signing Connector Cord Assembly		
140	Burner Pipe C	758	Relay Cord Assembly	700	Bath1 Remote Control USC1-117
141	Burner Pipe B	759	Fuse 3A	901	Main Remote Control UMC-117
142	Water Inlet Connector	760	Fuse 5A	903	Bath2 Remote Control USC2-117
143	Water Inlet Pipe Assembly				
144	Gas Inlet Connector Assy.			900	High Altitude Connector
		804	Screw FT 4 x 8	900	Sea Level Connector
204	“O” Ring P-10	813	Screw 4 x 8		
		827	Screw SW M4 x L12		
400	Water Inlet Thermistor	828	Screw Gasket		
405	Drain Valve Assembly	846	Screw 4 x 8		
408	“O” Ring P-8	854	Screw FT 4 x 8		
410	Water Control Assembly	858	Screw FT M4 x 10		
411	Drain Valve A	864	Screw 2 TP M4 x L10		
415	Heat Exchanger	871	Screw 2 TP 4 x 18		
		*	Specify NAT. Gas or L.P. Gas		

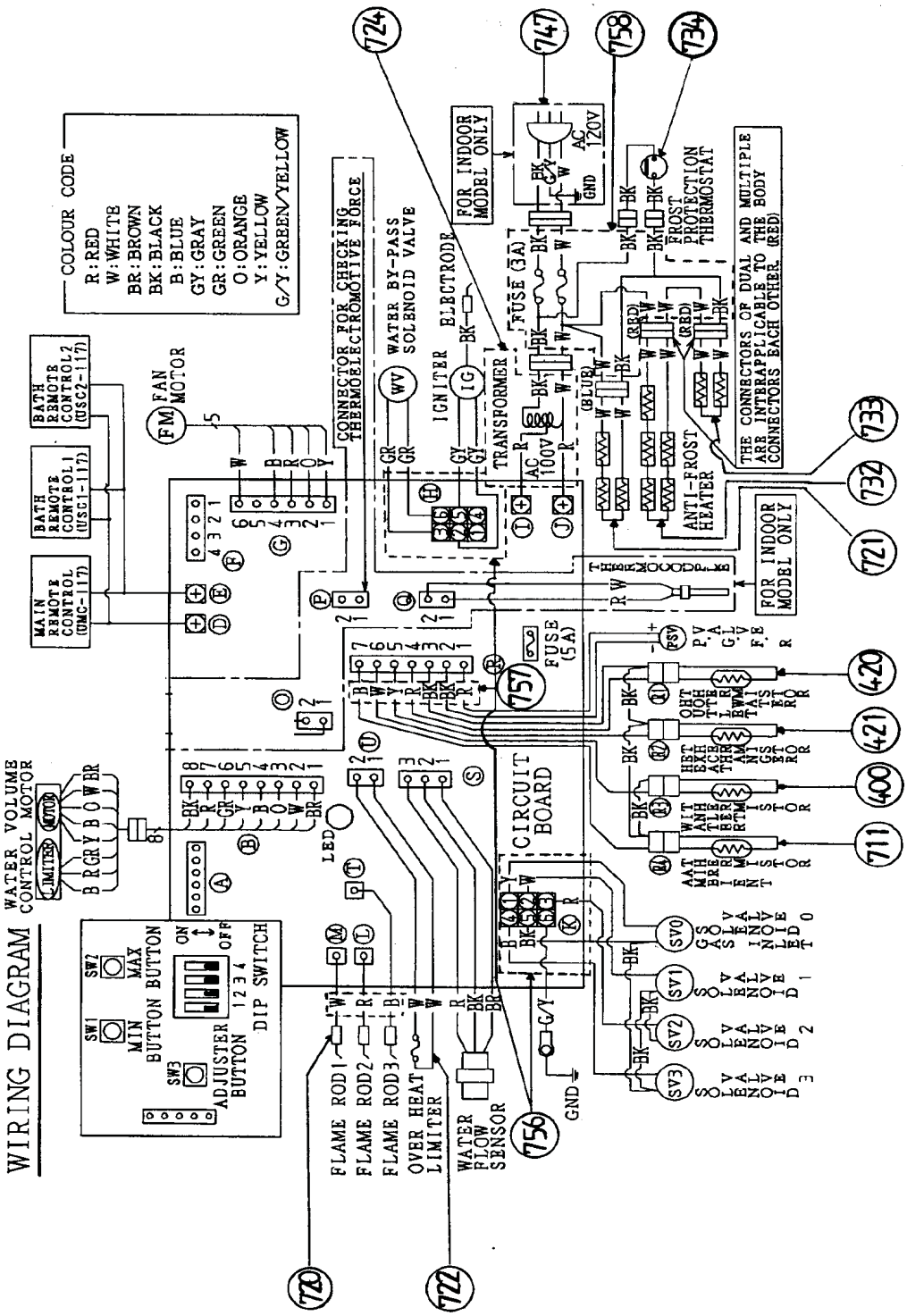
Schematic Disassembly (PH-28RDVS)



Schematic Disassembly (PH-28CDVS)



Schematic Disassembly (PH-28RDVS & PH-28CDVS)



Parts List for PH-28RDVS

No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover Assembly			896	Plug for Manifold Pressure
3	Back Cover Assembly	419	Flange		
4	Slide Bracket A	420	Hot Water Outlet Thermistor		
6	Support Plate	421	Heat Exchanger Thermistor		
7*	Burner Rod Assembly	422	Quick Fastener		
		429	“O” Ring P-12.7		
8	Back Cover Support Plate	445	Flange		
10	Air Intake Assembly	451	“O” Ring P-16		
100	Gas Shutoff Valve	706	Heater Holder C		
103	Gas Control Valve Assembly	708	Holder		
104	"O" Ring P-26	709	Heater Holder		
110	Igniter Holder	711	Ambient Air Thermistor		
112	Upper Burner Assembly	720	FR Connector Cord Assy.		
113*	Lower Burner Assembly R	721	Freeze Protection Assy. A	610	Nylon Clamp (Large)
114*	Lower Burner Assembly L	722	Film Type OHL	611	Nylon Clamp (Small)
115	Sensor Damper Holder	723	Burner Control Assembly	612	Gasket
116	Sensor Damper Plate	724	Transformer Assembly	613	Holder
117*	Sensor Damper	728	Fan Assembly	620	Screw TP 4 x 12 (For 610,611)
120	Flange C	729	Fan Case Assembly B	621	Screw M4 x 6 (For 704)
123	Igniter Assembly	730	Front Plate	622	Screw TP 4 x 16 (For 704)
125	Flange A	733	Freeze Protection Assembly		
132	Electrode (Flame Rod)	734	Thermostat Assembly	704	Bath1 Remote Control Only
133	Electrode (Spark)	747	Power Cord Assembly		
134	Isolated Tube				
137	Hot Water Outlet Connector				
138	Burner Pipe A	756	Wiring Assembly A		
139	Flange B	757	Signing Connector Cord Assembly		
140	Burner Pipe C	758	Relay Cord Assembly	700	Bath1 Remote Control USC1-117
141	Burner Pipe B	759	Fuse 3A	901	Main Remote Control UMC-117
142	Water Inlet Connector	760	Fuse 5A	903	Bath2 Remote Control USC2-117
143	Water Inlet Pipe Assembly				
144	Gas Inlet Connector Assy.	813	Screw 4 x 8	900	High Altitude Connector
		827	Screw SW M4 x L12	900	Sea Level Connector
204	“O” Ring P-10	828	Screw Gasket		
		846	Screw 4 x 8		
400	Water Inlet Thermistor	854	Screw FT 4 x 8		
405	Drain Valve Assembly	858	Screw FT M4 x 10		
408	“O” Ring P-8	864	Screw 2 TP M4 x L10		
410	Water Control Assembly	871	Screw 2 TP 4 x 18		
411	Drain Valve A	893	Screw FT 5 x 14		
415	Heat Exchanger	895	Screw FT 4 x 10		
		*	Specify NAT. Gas or L.P. Gas		

Parts List for PH-28CDVS

No.	Name of Parts	No.	Name of Parts	No.	Name of Parts
1	Front Cover Assembly			896	Plug for Manifold Pressure
3	Back Cover Assembly	419	Flange		
4	Slide Bracket A	420	Hot Water Outlet Thermistor		
6	Support Plate	421	Heat Exchanger Thermistor		
7*	Burner Rod Assembly	422	Quick Fastener		
		429	“O” Ring P-12.7		
8	Back Cover Support Plate	445	Flange		
10	Air Intake Assembly	451	“O” Ring P-16		
100	Gas Shutoff Valve	706	Heater Holder C		
103	Gas Control Valve Assembly	708	Holder		
104	"O" Ring P-26	709	Heater Holder		
110	Igniter Holder	711	Ambient Air Thermistor		
112	Upper Burner Assembly	720	FR Connector Cord Assy.		
113*	Lower Burner Assembly R	721	Freeze Protection Assy. A	610	Nylon Clamp (Large)
114*	Lower Burner Assembly L	722	Film Type OHL	611	Nylon Clamp (Small)
115	Sensor Damper Holder	723	Burner Control Assembly	612	Gasket
116	Sensor Damper Plate	724	Transformer Assembly	613	Holder
117*	Sensor Damper	728	Fan Assembly	620	Screw TP 4 x 12 (For 610,611)
120	Flange C	729	Fan Case Assembly B	621	Screw M4 x 6 (For 704)
123	Igniter Assembly	730	Front Plate	622	Screw TP 4 x 16 (For 704)
125	Flange A	733	Freeze Protection Assembly		
132	Electrode (Flame Rod)	734	Thermostat Assembly	704	Bath1 Remote Control Only
133	Electrode (Spark)	747	Power Cord Assembly		
134	Isolated Tube				
137	Hot Water Outlet Connector				
138	Burner Pipe A	756	Wiring Assembly A		
139	Flange B	757	Signing Connector Cord Assembly		
140	Burner Pipe C	758	Relay Cord Assembly	700	Bath1 Remote Control USC1-117
141	Burner Pipe B	759	Fuse 3A	901	Main Remote Control UMC-117
142	Water Inlet Connector	760	Fuse 5A	903	Bath2 Remote Control USC2-117
143	Water Inlet Pipe Assembly				
144	Gas Inlet Connector Assy.	813	Screw 4 x 8	900	High Altitude Connector
		827	Screw SW M4 x L12	900	Sea Level Connector
204	“O” Ring P-10	828	Screw Gasket		
		846	Screw 4 x 8		
400	Water Inlet Thermistor	854	Screw FT 4 x 8		
405	Drain Valve Assembly	858	Screw FT M4 x 10		
408	“O” Ring P-8	864	Screw 2 TP M4 x L10		
410	Water Control Assembly	871	Screw 2 TP 4 x 18		
411	Drain Valve A	893	Screw FT 5 x 14		
415	Heat Exchanger	895	Screw FT 4 x 10		
		*	Specify NAT. Gas or L.P. Gas		

Paloma Industries, Inc.
2151 Eastman Avenue
Oxnard, CA 93030
Phone: (805) 278-5499 or (805) 278-5480
Fax: (805) 278-5468

Printed in USA
2008-09